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CIVIL ENGINEERING.

Observations on the Adaptation of Public Buildings to the propagation of Sound, consistently with Speech. *By* Wm. Shand, Esq.

The following short observations are intended to show by practical illustration, the difficulties that have been experienced in regard to the economy of speech in apartments, and also the rules and means by which this may be effected.

General Remarks.—It is remarkable with what devoted assiduity men of science apply themselves to discover the cause of some peculiar phenomenon in nature, which, to many, appears of little importance, and may, by the rudest mechanic, be practically exhibited when the principles, or laws, by which it is produced are understood. When it was discovered that the electric fluid acted by the external surfaces only of conducting bodies, to a superficial observer it seemed of little consequence, but much time and many experiments were necessary to determine this.

When Sir Humphrey Davy discovered what led to the formation of the safety lamp, it appeared a trifling matter, but it cost this distinguished man of science much time and labor. The telescope, which brings so many distant worlds into view, is formed of bodies possessed of two simple properties—the opaque and pellucid—all else is artificial arrangement; and when optics was in its infancy, could

it have been anticipated that this science would have been brought to such a height of perfection, and that many educated and able men would devote themselves solely to one department of it?

Much has been effected in the economy of heat, but it is applicable in such a variety of ways, and to so many purposes, that although much of utility is known, probably still more remains to be understood.

Difficulties in copying an erection consistently with Acoustic Principles.—The most subtle and abstruse phenomenon in the whole range of physical science is sound, which has hitherto been an *ignis fatuus.* In the very limited space of a common apartment, individuals are seen opening their mouths, stretching their necks, and putting the hand to the ear in order to catch that which is not, a false sound being to the ear what occular deception is to the eye. All men fancy it to be within their reach—of this various instances are at present exhibited; and these remind us of a circumstance, related by several authorities, of some Jesuits who erected a building in imitation of one near Milan, where the sound of a pistol shot is repeated upwards of forty times, but although the copy was in appearance the same as the original, yet it was without an echo.

Desertion of Principles in copying Canon Mills, Edinburgh.—Canon Mills, (a place intended for the preparation of gas,) where the first General Assembly of the Free church of Scotland met, is now considered a model for the economy of speech; and several places of worship have been erected as true acoustic copies of this edifice, which consists of, in part, an earthen floor, walls of rough, solid masonry, and slates as they came from the quarry, affixed to wood as it left the saw, all being single, compact materials, with rugged exteriors, having little vibratory action, or sound, *the solidity of the bodies, and roughness of the surfaces,* being the principles that are favorable to articulation by producing limited *undulations;* but the rough surfaces occasion harsh sound on the ear, in the ratio of their proximity to it.

In the copies from the original, instead of being partly earth, the floor is all boarded, and hollow under, giving out much extraneous sound from the action of the feet, and other causes. The walls, instead of being solid and rough, are lined with lath and plaster, hollow between, and smooth on the exterior, consequently having comparatively much more action and sound than the original; while the roof is lined with lath and plaster, in like manner as the walls; not anything being retained in the copies consistent with the properties of Canon Mills, except the general form, which is bad. All this deviation from the original seems strange, when it is considered that not a single atom in a sonorous body can be added, or displaced, without influencing sound. It is also remarkable that an old building, intended for so foreign a purpose, and so rude, should be found more demonstrative of the economy of speech than all the works of art that have been intended for this purpose.

Instance of the class-room of a man of science, formed of similar materials, and producing similar effects as in Canon Mills.—I shall

now give another instance of rude and rugged materials producing similar effects, from similar causes, by moderation of action and sound. A celebrated physiologist, in his examination before the last Committee of the Commons, on the transmission of sound in apartments, &c., alludes to a particular class room, as constructed on scientific principles, and well adapted to the purposes of speech. In it the floor is of earth, the walls of solid and rough masonry, the roof is of unplaned plank, covered above with a thick coat of compost, and supported in the central parts by pillars of brick, in their original porous state: all being comparatively solid, and rough on their exteriors. The only material difference that I can perceive, is, that the old gas house, Canon Mills, is a matter of chance in regard to sound; whereas the learned doctor's class room has been constructed by a man of science; they are indeed very different in form, and yet form is the only point that architects seem to consider of importance in imitating Canon Mills. One advantage in both these places is, that *there is little glass exposed to the voice of a speaker.*

The materials used in Canon Mills, the physiologist's class room, the meanest cottage, or even the barn, are alike.

Erroneous to suppose that Undulatory Action should be lengthened, and Reflections prolonged.—The learned doctor, in his further depositions, recommends that the reflections of speech, in the Houses of Parliament, should be taken from the ceilings, transversely to the direction in which the human voice proceeds from the mouth; *the direction being horizontal whether we sit, or stand.* He also advises that the ceilings should be formed on the principles of a piano forte sounding board; thus increasing and prolonging sound, and the reflection of each letter more decidedly than the copyists of Canon Mills.

It may now be proper to ascertain by what means the principles by which the reflecting bodies, in these two apartments, are less ungenial to articulation, than where such are more sonorous and refined in appearance, as this may lead to the beneficial use of materials possessing similar properties, but less offensive to the eye.

Reasons why Speech is less indistinct in Canon Mills and the physiologist's class room than in more refined apartments.—Doctor Neil Arnot remarks, that when sound is reflected by a solid, the angle of incidence and reflection correspond; and he illustrates this by a boy's hand ball thrown against a wall, when the angle of reflection is equal to that of incidence. But the analogy applies only in a limited degree, because the ball is kept together in mass, whereas, the component parts of the atmosphere are scattered and divided, and so is sound, as our sense of hearing tells us. The greatest repelling force is, no doubt, in one direction, but the matter that gives effect to sound passes, in a certain degree, in all directions; the particles in the atmosphere impinging on a rough surface, press in various directions, in conformity to the minute angles presented to them, and consequently occasion less vibratory and undulatory action in the reflecting body than when the surface is smooth, and the pressure in one general direction. The component parts of the atmosphere thus recoiling

in various directions, strike upon, oppose each other, and from this cause also lessen the sound. If the ear be near to such rough surfaces, they occasion harsh sound to be transmitted to the nerve of hearing; but at a little distance, the atmosphere again runs smooth, and produces no such effects.

I would next observe, as to the earthen floor, that the action and sound from it are much less than from hollow boarding;—the earth is comparatively soft, little elastic, and rough externally—for these reasons, sound from it does not sensibly affect the ear, nor cause any reaction from the roof. These facts may be learned from the ground in general producing no confusion either in speech, or music. The earth has also an action different from hard bodies of limited thickness, such as boards, lath, and plaster, by which motion and sound are lessened in these materials.

Angular Surfaces calculated to prevent extraneous sounds from reaching the ear.—The apartments just alluded to, are, I conceive, better calculated to demonstrate, by the rough surface and comparative solidity, the means by which harsh and ungenial reflections may be prevented from reaching the ear, than to exemplify the manner in which consistent reflections are to be obtained.

Instances of extreme confusion, prevailing for years, without any attempt to remedy this.—In order further to point out the difficulties that have been experienced in forming, and in copying rooms intended for speech, I would refer to my pamphlet on the Economy of Speech in Apartments, in which instances are pointed out, in various localities, where utter confusion prevails. Two very remarkable instances are, the church in Edinburgh, in which the General Assembly of the Church of Scotland met several years ago, but which they were compelled to desert, because they could not understand each other; there is great confusion throughout, and two of the galleries have ever since been locked up; nor has any attempt been made, so far as I know, to reclaim these. The other is St. Luke's Church in Liverpool, where the patrons have been rolling the incumbent from place to place, for a series of years, in a locomotive pulpit, with a drum canopy over it, thus increasing the evil wherever they go, instead of remedying it. If the matter be simple, as many say, why has not speech been rendered intelligible in these two edifices?

Sound reflected from Sonorous Solids in Apartments, in at least six directions, must necessarily confuse Speech.—It may be remarked that an apartment for speech being a work of art, in which solids are in a limited space, and most of them sonorous, when from the human voice, or any other cause, sound is produced by rapidly agitating the atmosphere, it impinges on, and recoils from, the sonorous solids, on the walls, the floor, and the ceiling, in at least six different directions; and if the agitation be great, the effects are similar to what is produced in the ocean, when waves meet from various directions in a small compass, occasioning, by their conflict, confusion in sound, as it has already done in the atmosphere, by which it is conducted.

There are various ways of exemplifying this in apartments, and in the atmosphere, where sound is not confined.

All Curvatures, by concentration, confuse Speech.—Notwithstanding that all writers on this subject, so far as I have been able to ascertain, recommend excess of sound, and several advise its concentration, or being made to act in foci, wherever the human voice, in speech, acts within a curvature, articulation is deranged, and the greater the curve, and the more sonorous the material, the greater is the perturbation.

The evil of extreme agitation, by changing the original character of sound, is exemplified in that of a bell, the sound of which is most clearly, intensely, and distantly heard, when there is an extremely light current of air moving from the bell towards the ear; but if the wind be strong, the component parts of the air are deranged, and sound is not heard so intensely, distinctly, or distantly.

Sonorous Solids conduct Sounds generally with velocity and intensity in a similar ratio, but in air it is equal in Velocity and Character throughout.—Sonorous solids are considered to conduct sound with velocity, much in the ratio of the intensity with which it is produced—concrete plaster 11 or 12 times, and glass and fir wood with 15 or 16 times its velocity in common air. In the atmosphere it passes with equal velocity in all directions, if no more dense medium should intervene between the source of sound and the ear, and it is *conducted without change of character.* In solids, its character and direction are changed, and the degree of sound depends on the density of atoms, and their distance from each other. When sound reaches a solid, its direction and character are changed, from various causes, according to the nature and form of the solid. It is produced by cohesion, repulsion, and friction in the atoms, and the degree of sound is, therefore, in a great measure, dependent on the density of the atoms, and their distance from each other; thus, silver and gold are less sonorous than copper, bell metal, or glass; and lead, which is peculiarly soft, is less sonorous than any of these bodies.

Sound acts similarly in the Musical String, and in Wood of long fibre.—There are other properties and arrangements in certain materials, which appear to operate, by their cohesive and repulsive principles, most powerfully in one direction; for instance, in wood of long fibre *it acts predominantly in the direction of the fibre, similarly to that in the musical string.*

Not only do these circumstances lead to a knowledge of the degree and character of sound emitted from various bodies, and tell us that every atom acts its part in producing it; but an understanding of all these points is necessary for the control and guidance of this singular phenomenon.

Sound being produced in Solids, acts throughout all their atoms.—On striking a solid, so as to produce sound, every atom in it is set in motion, and if another sonorous solid be in contact with it, similar effects are produced in the second as in the first solid, until by friction the atoms are brought to rest, when sound also ceases.

Predominating influence in the solids, but air also necessary to produce Sound.—For the reasons given, in the solids* usual in apart-

* Professor Liebig says, that every atom in the earth has its own atmosphere, and every

ments, sound operates with more intensity and rapidity than in the atmosphere alone, (although the solid must be in contact with air,) but the predominating influence is in the solids.

It is evident, from these and other understood facts, that it is in the solids in and surrounding an apartment, that sound must be regulated.

Cross Sounds not admissible, &c. Necessity of regulating Undulation in the solids.—I have already explained that neither cross sounds, nor excessive sound, is admissible, and that reflections which reach the ear must fall on the pinna horizontally—that the undulatory motion in the reflecting bodies must be regulated; and I shall further demonstrate the means by which this is to be effected, and those by which cross sounds are to be withheld from the ear, without exposing soft non-sonorous materials, so as to arrest the tremulous atmosphere and sound generally in an apartment. I have certainly explained enough to convince the most sceptical that it is preposterous to imagine that all that is requisite to be attended to is the mere form of a room, or that materials may be thrown together indiscriminately, conducting and reflecting in various directions, and in any degree. As sound passes with equal velocity in all directions in the atmosphere, the first solid that the voice of a speaker must operate on, is that nearest to him, and, being conducted with so much greater rapidity by the solids than in air, it must pass by the solids, and by these be given out to the atmosphere.

Effects of the predominating velocity and intensity of Action and Sound in the Solids.—For instance, supposing an apartment eighty-five feet in length, and half this width, and that the speaker is placed in one end against the wall, the sound of his voice passes by the atoms of the solids in the walls to the other end of the room, when it is only a few feet from his mouth in air, and as *undulation succeeds undulation* with so much greater rapidity and intensity of effect in the solids than in air, the predominating influence must be in the solids.

Prevention of Echo insufficient to economize Speech.—Many suppose that preventing echo and a repetition of reflection is sufficient; but this is only a palliation of the evils experienced, because a single reflection, although it may be prolonged too much, is less prejudicial than a repetition of reflection.

For the reasons given, irregular reflections of the voice and extraneous sounds are so general, that, although the ear may not be sensible of these individually, they interfere more than we are aware with those which convey distinct and intelligible sounds to the nerve and sense of hearing.

Further general observations.—In different phenomena, causes and effects vary; but, reasoning by analogy between hearing and sight, I would remark, in regard to the faculty of vision, that, if the

atom in the finest metal must have its own atmosphere to produce sound. He also remarks, that cork and India rubber have done more than any thing else, in the course of the last fifty years, for the improvement of chemistry; and such bodies as these, buff leather and woolen cloth, may do much for the economy of sound.

eye be directed to two objects at the same time, perception is less in both than if concentrated on one object. Are not cross lights, or rays, approaching the eye in transverse directions prejudicial? and shall sound, without measure, or adjustment, be communicated to the ear with impunity?

Reasoning further by analogy, the question may be asked, how are such effects produced in Newmachar Church, as are pointed out by those who have preached in it? Does not the soft, absorbent material (as it is termed) diminish sound as much as any thing that we know?—and yet they say that they were heard distinctly at any natural pitch of their voice in all directions, and they believe that similar principles and arrangements may be adopted in apartments of any extent with advantage.

The circumstance alone of speaking without oppression, and with ease in all places where the soft material has been used, is, of itself, very important, as many say they would rather speak a whole day in one place, than two hours in another place. The following hypothesis I believe to be applicable in this case:—

If several musical instruments are in tune, and operating in concert, the ear receives their sounds from a distance as of one instrument; but if any instrument gives out discordant sounds, this tends to overcome the more musical sounds, and derange the whole. Precisely such are the effects produced by reflected sounds from the solids in an apartment; in the one case, they give consistent strength and effect to each other, but in the other case they produce discord. If in a room certain of the walls are of solid masonry, and others of lath and plaster, and the ceiling is on the principles of a piano forte sounding board, all having different degrees of action and sound operating in opposition to each other, is it possible that there can be any accordance in the sonorous effects? Causes and effects are in this case similar to that of a complicated piece of mechanism, in which the parts do not fit and move together, but oppose each other; for sound is entirely the offspring of mechanical action in the matter which produces, or conducts, it.

Mode of Regulating Reflected Sounds intended to reach the ear.—The chief objects in the arrangements alluded to, are to obtain reflected sounds of the voice in speech from vertical bodies, so that they may be delivered horizontally on the pinna of the ear, being obviously the direction in which this expanded vibrating lever is best calculated to receive these.

All such reflected sounds must be regulated by the undulatory action in the reflecting solid, each undulation being made to conform in time and duration of sound, as nearly as may be, to the motion of the mechanism of the mouth in the formation of every distinct letter; and these reflections must not be so excessive as to produce any sensible reflection, or echo, from an opposite solid. To effect these objects, soft non-sonorous material is placed behind, and on the edges of the reflecting sonorous bodies, according to circumstances, so as to moderate the reflections, *and shorten the undulations.*

Nature points out that the reflected sounds of the voice should fall

on the ear in a horizontal direction, because the voice proceeds from the mouth in this direction whether we sit, or stand, and, because all cross action in the atmosphere differing from this, is found prejudicial.

Means for Preventing Irregular Sounds from reaching the ear, &c.—In order to prevent cross action and derangement in the sonorous atmosphere, and in speech, and to keep extraneous sounds from the ear, a greater proportion of soft non-sonorous material must be placed on the unexposed parts of the ceiling, and on all sonorous bodies that do not reflect horizontally; but this soft non-elastic material must not be exposed to the atmosphere, or the direct action of the voice, except on the floor, because in this case it damps the sound of the voice too much throughout an apartment.* Extraneous sounds may also be operated on by means of rough, or angular, surfaces, so as to cause the particles in the atmosphere to act in opposition to each other, in order to break and divide sound, and thus prevent it from reaching the ear. Nature exhibits to us the surface of the ground always in a rough state, so as to prevent any moderate degree of sound, such as emanates from the human voice, from occasioning confusion, because the reflections do not reach the ear.

Note.—Lath and plaster are not the most desirable materials for the lining of an apartment; and, in the two Aberdeen churches, the windows are injudiciously and prejudicially placed without sufficient means being adopted to keep back from the ear the intense and irregular sound given out by the glass.

Glasgow Mech. & Eng. Mag.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On Breast Water-Wheels.

In the year 1833, at page 6, vol. xi, of this Journal, we published an elaborate and able series of experiments, made by Ithamar A. Beard, on the *Breast Water-Wheels*, driving one of the Hamilton mills, at Lowell, Massachusetts. There were three water-wheels in this mill, each thirteen feet in diameter, and fourteen feet long in the bucket, or having forty-two lineal feet of bucket in all—their tops being level with the surface of water in the head race.

The water was drawn upon each of the water-wheels, during these experiments, by two gates, the upper drawing under a head of about *one foot*, and the lower drawing under a head of about *two feet*, so that, although called *breast wheels*, the water was let on so much above the centre, as probably to render the name of *pitch back overshots* more properly applicable to them.

The careful experiments above referred to, *show that these wheels realized a coefficient of effect of* .6019.

Conformably to this result, *about sixty per cent.* has usually been regarded as the coefficient of effect in breast water-wheels of this

* By the expansion of air in a room, it ascends, and sound with it, acting predominantly on the roof, and little on the floor; soft material may, therefore, be placed on the floor in order to annihilate sound from the feet, &c., without injury to the voice of a speaker.

class, whilst those which draw on their water lower, have been thought even less efficient; but some experiments recently made upon the continent of Europe, develope the singular result, that when nicely constructed, *simple breast water-wheels may realize a coefficient of effect of more than eighty per cent!*

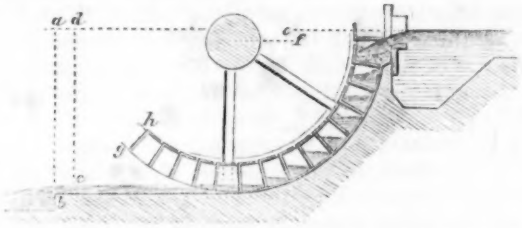
In other words, that a common breast water-wheel actuated by a fall of water of only about two and three-fourths metres, or nine feet, was, in the case referred to, *fully equal in effective power to any over-shot water-wheel!*

This being a result equally singular and interesting, we have translated below the experiments which develope it.

COM. PUB.

Notes on a Water-Wheel established in a Bleachery at St. Amarin. By M. MAROZEAU, *of Wesserling.—Translated for the Journal of the Franklin Institute, from the "Bulletin de la Société Industrielle de Mulhouse."*

This water-wheel is of the kind called plane bucket, or *breast wheel*, and is inserted in a circular sweep, or breast. The following figure shows the principal dispositions of a section across the middle of the axis, or shaft, of the wheel:



a b=2.750 metres, or 9.02 English feet; *c d*=2.674 metres, or 8.77 English feet; *e f*=0.160 metres, or 0.52 English feet; *g h*=0.445 metres, or 1.46 English feet, being the clear depth of the bucket. Diameter of water-wheel about seventeen feet.

The wheel, the breast, and the gates, are of wood, which was adopted for the sake of economy, and executed with all the care and precision desirable. The planes of the buckets are in the direction of the radius.*

The counter buckets (or soleing) leave in the upper part of each bucket a longitudinal opening of .013 metres, or *half an inch*, in width. Besides the two extreme rings, or shrouding, there are two others intermediate, which divide the buckets into three equal parts. These interior partitions, which add much to the solidity of the wheel, are, moreover, destined to answer another purpose, of which we shall speak further.

* The advantageous results developed by this wheel with radial buckets, show how unnecessary it is to construct them with elbows, or inclined to the radius; both of which methods, and especially the elbow buckets, are very much used in the breast water-wheels of this country. COM. PUB.

The circular sweep, in its upper part, is, by a parabolic curve, brought to an even surface, with the portion of a parabola, which forms the sill of the gate; at its lower part it is terminated by a tangent plane, descending about one-tenth of a foot in its length of 9.84 feet, or at the rate of one in one hundred. The outer extremity of this plane, or apron, forms a sill, or step, (.30 met.) .98 feet high above the bottom of the tail race. The gate (which is of the waste-board form, so as always to draw on the water from the surface,) has its top formed of a parabola, calculated for a depth of water over it of (.20 met.) or .65 feet. Four partitions, placed opposite to the four rings of the wheel, divide this waste-board gate into three spaces, or bays, the breadths of which are a little less than those of the corresponding portions of the buckets. Each of these bays can be closed by a thick oak plank, so managed by rods that the water may be admitted at will by one-third, two-thirds, or the whole of the gate.

The origin of the fluid vein flowing over the up stream edge of the sill of the gate, is about (.46 met.) 1.50 feet distant from the wheel, so that for a lowering of the gate of (.020 met.) .656 feet, this fluid vein strikes the buckets at a mean vertical depth of (0.40 met.) 1.312 feet, or with a velocity of about (2.80 met.) 9.18 feet per second.

The greater part of these arrangements are comformable to those of wheels before described, and admitted to act satisfactorily; but there are some which appear to me novel, and on them I wish to fix the attention of the "Société Industrielle:" I will speak, first, of the intermediate rings of the wheel, and of the corresponding partitions adapted to the gate; second, of the distance of the gate from the wheel.

We have before stated how we can at will receive the water by the third, the two-thirds, or the whole of the breadth of the gate—the two interior rings dividing the buckets, so that in these several circumstances the water exerts its force on the third, the two-thirds, or the whole of each bucket.

We have adopted this arrangement with the view of making the water act on the wheel in a manner sensibly equal, though very variable, volumes be expended. In effect it is evident that the thickness of the billow of water introduced upon the wheel, has a great influence upon the results, whether by the manner in which it arrives and strikes upon the buckets, or by its mode of action in the circular breast, and in this last respect, notwithstanding the careful construction of the wheel, it is certain, that there is always an appreciable interval between the buckets and the breast, by which a portion of the water escapes without effect on the motor.

The loss of power due to this circumstance being sensibly proportional to the breadth of the breast, we see that so long as this breadth remains the same, the loss will affect the result so much the more, as the quantity of water acting may be the less considerable. But if, at the same time that the expenditure of water diminishes, we contract the breadth of the breast, we may hope to establish a sort of compensation leading to very nearly identical results. This, in fact, *has now been confirmed by experience.*

I come now to speak of the distance of the gate from the wheel, and of the form to be given to that part which forms the waste-board, (or sill over which the water flows upon the wheel.)

M. Morin, in his Memoir on Water-Wheels, (Metz, 1836,) page 66, advises the adoption of waste-board gates *placed the nearest possible to the wheel.*

Ours is remote, since there exists a distance of (0.46 met.) 1.509 feet between the wheel and the up-stream edge of the sill of the gate.

Thus by this arrangement the fluid vein strikes the buckets nearly perpendicularly, at a point very near the breast, and with a velocity, which, at a mean, only surpasses that of the buckets by about (1 metre) 3.281 feet per second, of an opening of 0.20 metre, or .656 feet —a velocity which diminishes in proportion as this opening is itself diminished, but which, nevertheless, always exceeds that of the buckets, a condition indispensable to the proper introduction of the water.

In drawing more of the gate of the wheel, we expose it, on the one hand, to carry the fluid vein upon a part of the bucket very near the soleing, or on this soleing itself; and, on the other, to cause it to strike the buckets at a point where their velocity exceeds that of the entering fluid, which will occasion a shock in a direction contrary to the movement.

Of itself, this observation, which appears not without importance, urges us to declare, that the advice given by M. Morin, in the work before cited, has served, in the main, as the base of the other arrangements which have been adopted for the construction of the wheel; and experiment seems to prove, we have had reason to take it, for a guide.

We will now say a few words on the inclined plane which terminates the circular breast. We find it employed in very ancient water-wheels, and yet in many recent constructions it has been suppressed. This is evidently wrong, for in preserving to the water which issues from the wheel, the velocity which it has in common with the buckets, it is clear we facilitate its disengagement, and we can use this same velocity to repel the water of the tail race, which may thus, without inconvenience, elevate itself to (0.10, or 0.15, met.) .328, or .492, feet above the lowest point of the wheel.

To verify the justness of the principles of which the preceding is an exposition, experiments with the *friction brake* have been made on the wheel in action.

The brake used is that of the establishment of Bitschwiller, which M. M. Stehelin and Huber have had the kindness to loan us, and which has been applied under the direction of one of their hands accustomed to experiments of this kind. The pulley of this brake is (0.70 met.) 2 296 feet in diameter, on a breadth of (0.26 met.) .853 feet; the length of the lever is (3 metres) 9.843 feet.

It was placed on the prolongation of the shaft of the wheel, so that the resistances to be overcome were, besides those of the brake, the friction of the shaft of the wheel on its two bearings, and that of the additional shaft on its single bearing.

We see then that the power consumed by the brake may be sensi-

bly considered as equal to the useful effect transmitted by the wheel. The precautions known to be necessary in applying the brake, were scrupulously observed. The numbers inscribed in the table relate to the periods, during which we observed a great regularity in the oscillations of the brake, and in the velocity of the wheel.

The gauging of the water we had only the power to make by a single method: we noted the depth, H, of the sheet of water on the sill of the gate, and from it deduced the volume of water issuing by the known formula,

$$Q = m\mathrm{HL}\sqrt{2g\mathrm{H}},$$

H = the vertical depth of the edge of the gate below the level of the head race, was taken at a point (1.50 met.) 4.92 feet above the gate. The constant m, was assumed at 0.4.

We maintained very precisely (by means of a regulating gate,) the surface of water, in the head race, at a constant height during the whole time of the experiments.

Below, when the wheel was stopped, the water backed up to the lower extremity of the inclined plane which terminates the breast. The fall was counted from the surface of the head to that of the tail water, taken at the lower extremity of the inclined plane.

Occasionally the level of the water varied somewhat below; but it is evident that we might elevate its surface sensibly without prejudicing the motion of the wheel, and, consequently, the falls adopted in the calculations are rather too great than too little.

If we cast our eyes upon the following table, we see that it is divided into *nine series*, of which—

The first *three*, A, B, C, are relative to expenditures of water, which differ little from (200 litres) 12,200 cubic inches, or 440 pounds per second.

The *fourth* and *fifth*, D and E, relate to expenditures of (300 litres) 18,300 cubic inches.

The *sixth* and *seventh*, F and G, relate to expenditures of (400 litres) 24,400 cubic inches.

Finally, the *last two*, H and I, relate to expenditures of (500 litres) 30,500 cubic inches.

The power of the brake did not permit of going beyond this.

Having compared the results recorded in this table, let us observe, that those of the *three last series* appear superior to what we should have expected, and to what are generally admitted.

As this became known to us during the course of these trials, we redoubled our attention, and verified minutely all the bases of our calculations, in order to see if we could not find errors; but not a single mistake could be discovered, and the regularity of the results of the three series, G, H, I, to which they relate, render it improbable that any of importance can exist.

The only debatable point is the application of the formula for gauging the water,

$$Q = m\mathrm{LH}\sqrt{2g\mathrm{H}};$$

in using which we adopted the constant coefficient of 0.4 for m, which is very nearly the average of those resulting from experiment; but of

all the means usually adopted, this, which is the most simple, appeared to me also the least liable to error, when we took care (as we did) to maintain the level invariable during the whole series of experiments.

We believe ourselves safe, then, in regarding as true, or rather as approaching very near to the truth, the results of our experiments, which we may sum up as follows:

I. When the water is conducted to the wheel by the *three* bays of the gate, and when the lowering of the gate is comprised within the limits of (0.15 to 0.20 met.) .49 to 0.65 feet, which corresponds to a volume of water of (400 to 600 litres,) 24,400 to 36,600 cubic inches per second, the effective power of the wheel deviated but little from eighty per cent., (see series G, H, I.)

II. This effective power diminished for smaller volumes of water; it is only seventy-three per cent. for (300 litres) 18,300 cubic inches, and fifty-two per cent. for (200 litres) 12,200 cubic inches, (see series E, C.)

III. The effective power for (200 litres) 12,200 cubic inches, rose to sixty-six per cent., when we employed *the two side bays* of the gate, and it reached seventy-one per cent., when we used only that of the middle,* (see series A, B.)

IV. For an expense of (300 litres) 18,300 cubic inches, there is not much difference between the use of the entire gate, and that of the two side bays only.

V. The velocities of the circumference of the wheel may vary without sensibly influencing the effective power from (1.40 met.) 4.59 feet, to (2 met.) 6.56 feet per second.

At a time when the views of constructors are turned towards the means of realizing the best possible effect from water powers, and when many systems of motors are presented, it seems to me useful to call the attention of the "Société Industrielle," to the good results obtained with a wheel of a simple and economical construction, which may be employed in many circumstances.

Explanations referring to the Table.

met.—French metres, each 3.281 English feet. kil.—French kilogrammes, each 2.20485 avoirdupois pounds, or nearly two and one-fifth pounds. km.—A French dynamical unit, being kilogrammes lifted one metre high in a second.

A horse power of 33,000 pounds, lifted one foot high per minute, is nearly seventy-six and one-fourth km.; the horse power generally employed in France, as a dynamical unit, is seventy-five km. A litre is 61.02802 cubic inches, which quantity of water weighs just a kilogramme, so that in measuring this fluid, litres and kilogrammes are identical in weight.

It will be perceived that the clear length of bucket in this wheel is about 12½ feet; and that its available force with the entire gate drawn down 0.20 metres, or .656 feet, is about 18 horse power.

* This and the preceding prove conclusively, that the same quantity of water confined, so as to form a thick sheet in flowing over the gate, is much more effective on a breast wheel, than when the same volume is used in a thin sheet, *the difference here shown being as 52 to 71.* Com. Pub.

Number of Series.	Number of Experiments.	Disposition of the Gate.	Breadth of the Orifice.	Depression of the Gate.	Weight of water expended per second.	Height of the Fall.	Theoretical Power of the Motor per second in km.
			Met.	Met.	Kil.	Met.	Km.
A	1 2 3	The middle bay.	1 247	0 202	200	2 725	545 "
B	4 5 6	The two extreme bays.	2 463	0 127	198	2 725	539 55
C	7 8 9 10	The three bays, or the entire gate.	3 710	0 095	193	2 725	525 92
D	11 12 13	The two extreme bays.	2 463	0 169	303	2 710	824 13
E	14 15 16	The entire gate.	3 710	0 129	304	2 710	823 84
F	17 18 19	The two extreme bays.	2 463	0 192	367	2 705	992 73
G	20 21 22 23	The entire gate.	3 710	0 154	398	2 700	1074 60
H	24 25 26 27	The entire gate.	3 710	0 180	502	2 685	1347 87
I	28 29 30 31	The entire gate.	3 710	0 204	605	2 685	1624 42

Number of turns of the Wheel in a minute.	Velocity of the outside circumference in a second.	Load of the Brake.			Useful Effect, or Power available, per second.	Ratio of the Useful Effect to the Power Expended.	Mean of these Ratios by Series.
		Constant.	Variable.	Total.			
	Met.	Kil.	Kil.	Kil.	Km.		
7 "	1 876	71 80	105	176 80	388 80	0 71	
6 "	1 608	"	135	206 80	389 80	0 72	0 71
5 26	1 410	"	165	236 80	391 55	0 71	
6 56	1 758	"	105	176 80	364 93	0 67	
5 57	1 493	"	135	206 80	361 "	0 66	0 66
4 80	1 286	"	165	236 80	357 "	0 67	
5 "	1 340	"	105	176 80	277 80	0 52	
4 41	1 182	"	135	206 80	286 63	0 54	0 52
5 90	1 581	"	75	146 80	272 18	0 52	
6 46	1 631	"	60	131 80	267 55	0 50	
7 "	1 876	"	195	266 80	586 74	0 71	
6 "	1 608	"	245	316 80	597 17	0 73	0 72
5 09	1 364	"	295	366 80	585 94	0 71	
7 "	1 876	"	195	266 80	586 73	0 71	
6 "	1 608	"	245	316 80	597 17	0 73	0 72
5 22	1 399	"	295	366 80	691 23	0 73	
6 31	1 691	"	295	366 80	727 82	0 73	
6 88	1 844	"	265	336 80	728 53	0 73	0 73
5 33	1 428	"	355	426 80	715 12	0 72	
7 62	2 042	"	295	366 80	878 "	0 82	
6 88	1 843	"	345	416 80	901 47	0 84	0 82
6 09	1 632	"	395	466 80	892 67	0 83	
5 22	1 399	"	440	511 80	838 91	0 79	
6 56	1 758	"	440	511 80	1055 18	0 78	
6 56	1 758	"	460	531 80	1096 25	0 81	0 795
7 12	1 908	"	410	481 80	1077 52	0 80	
6 72	1 800	"	435	506 80	1069 95	0 79	
8 "	2 144	"	460	531 80	1336 58	0 82	
7 05	2 010	"	485	556 80	1311 95	0 80	0 81
7 25	1 943	"	510	681 80	1326 64	0 82	
6 88	1 844	"	535	606 80	1312 57	0 81	

FRANKLIN INSTITUTE.

Explosion of the Locomotive Engine "Richmond."

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts, to whom was referred the examination of the causes which led to the Explosion of the Locomotive Engine "Richmond," upon the 2d of September, 1844, respectfully REPORT:—

That they have used all the means in their power to collect information upon the subject of the explosion; they examined with great care the remains of the engine, as exhibited at the shop of the Messrs. Norris, and have obtained statements of the facts from all those who were near at the time of the explosion, and those, who, from their position, were in a situation to judge of the condition of the engine.

The following narrative contains all the material facts brought to light by their investigation, and is based entirely upon these facts:—

The locomotive engine "Richmond," weighing, when in working order, sixteen and a half tons, (33,000 lbs.) was built by the Messrs. Norris, of this city, and placed upon the Reading Railroad. The boiler was constructed upon the same general principles as those of other modern engines of the same weight. The fire-box was forty and a half inches wide at the widest part, forty and a half inches deep, and forty-two and a half inches high; the back plate, into which the flues were inserted, was thirty-six and three-fourths inches in breadth; the crown was nearly flat, and was stayed by seven cast-iron bridge-bars upon its top, which sustained the crown by means of stay-bolts passing through both crown and bar. These cast-iron bridge-bars were nearly rectangular in their cross section, which varied in dimensions averaging three and three-fourths inches in depth, and one and seven-sixteenths inch in breadth; but the cross section of the solid metal at the stay-bolts was less than this. These bridge-bars did not extend entirely across the crown of the fire-box, so as to rest upon its vertical sides, but terminated about one-fourth of an inch short of the bend by which the crown is joined to the sides. They were not in contact with the top of the fire-box, except at their ends, and at the washers of the stay-bolts, but had a space between, which, at their centres, where it was greatest, amounted to about one-fourth of an inch.

The engine was placed upon the Reading Railroad upon the 14th of August, 1844, and continued to run until the 2d of September, with but few and trifling intermissions; the only one of importance of which, was caused by a required alteration in the valve-rod of the cut-off valve gearing, which change was made at the shop of the Messrs. Norris. The greatest amount of load which the engine had, up to this time, pulled, was seven hundred and sixty tons gross, and the greatest pressure of steam to which it had been subjected, is supposed to have been about one hundred and fifty pounds per square inch. After the alteration in its valve-rod, the engine had made eight trips,

four of which were down the road from Pottsville to Philadelphia, drawing an average load of six hundred and five tons, and four were up the road, drawing, on an average, two hundred and thirty-two tons gross. (It will be recollected, that the road is so constructed as to have no ascending grade in the passage from Pottsville to the Falls of Schuylkill: the loads down are generally cars laden with coal, the loads up, the empty cars.) No defect was found in the working of the engine, except that, as will be seen by the evidence, the pumps had been found to give even more trouble than is usual in new engines. The pumps in the Richmond were placed immediately under the steam cylinders, the supply valves being at the forward end of the cylinders, and the check valve at the point where the water enters the boiler, a short distance behind the cylinders. The pipe leading from the supply valves to the boiler passes between the cylinder and boiler: the try-cock is upon this pipe, and just behind the cylinder. On Saturday, August 31st, upon the down trip, it was found necessary to stop the engine near Manayunk, and take the pumps apart; and it will be found, by the testimony of Mr. Day, that upon the very day of the explosion, at Pottstown, Mr. Ward, the engineer of the Richmond, was occupied in unscrewing the caps of his pumps, in order to get them to work.

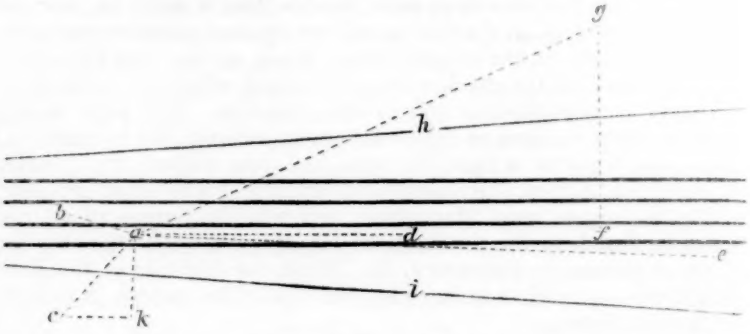
Upon the 2d of September, the Richmond reached Reading from Philadelphia, at 7h. 18m. P. M. At this time there is every reason to believe, (although there is no direct testimony to this effect,) that the water was high in the boiler:—the steam was low, and the valves were not blowing off. At the depot at Reading, the engine took in a supply of fuel, (oak wood) and filled its tank with water. No fan was used upon the engine to increase the draft.

It was detained at the depot sixty-seven minutes, during the latter fifteen of which it was shifting cars, and preparing to start; whether the fire doors were left open during this time is not recollected, but when the engine left, the steam was blowing off moderately at both valves, at a pressure of about one hundred and twenty pounds. During the period of the detention of the engine at Reading, a violent thunder storm from the north-west was raging at that place, but before the engine left it had passed off to the south-east, and the rain had so far ceased, that Mr. Ward had laid aside his water-proof overcoat: the night, however, remained exceedingly dark.

After leaving the depot, the engine hauling a load of eighty-eight empty coal cars, (weighing two hundred and eleven tons,) passed up the road, through the borough, at the rate of four, or five, miles per hour. Fifteen minutes after leaving Reading, and at a distance of 2.02 miles from the depot, the boiler exploded. The time of the explosion is indicated by the stoppage of the conductor's watch, which was crushed in his pocket, by his fall upon the sills. The road at the point at which the explosion took place, runs upon an embankment five feet high, and has an ascending grade of six feet per mile. At the exact place of explosion the road is straight, but the train behind lay in a curve of three thousand feet radius.

The condition of things, as found immediately after the explosion,

was as follows:—(The accompanying diagram, kindly furnished by Mr. Nicolls, the superintendent of transportation of the Reading Railroad, will render the description more intelligible.) The road at this point runs nearly north and south; the boiler itself, with its cylinders, dome, and fire-box, was thrown to the north-west, a distance of two hundred and forty-nine feet; its distance in a perpendicular direction west of the centre of the track being seventy-eight feet.



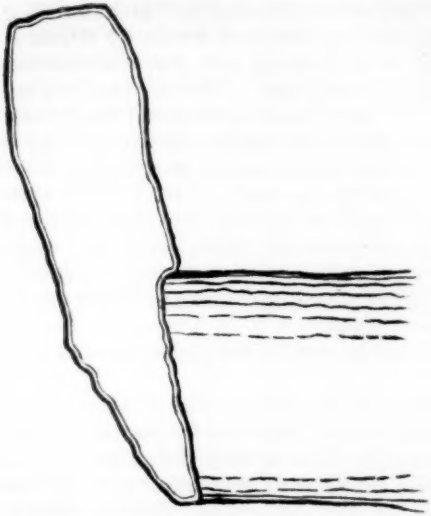
a, spot where the engine exploded; *b*, body of fireman; *c*, body of engineer; *d*, body of fireman; *e*, body of conductor; *g*, spot where the engine lodged; *h*, foot of embankment; *i*, ditto.

a b, 20 feet; *a c*, 54 feet; *a k*, 32 feet; *a d*, 155 feet; *a e*, 326 feet; *a g*, 249 feet; *k c*, 44 feet; *f g*, 78 feet; *e*, to the rail is about 4 feet.

The embankment is five feet high at *a*, and eleven feet at *f*; the line is straight, and rises from *a*, towards *f*, at the rate of six feet per mile.

This sketch is not drawn by a scale, though the measurements were taken on the ground.

The boiler was found lying with its cylinders to the north, and its fire-box towards the south, its axis nearly parallel to the track, its dome was downwards, and its safety valve seat broken at its upper edge; the blow, in lighting, had taken effect upon the hinder part of the boiler, and near its right side, and by this blow the fire-box, and the part of the boiler surrounding it, had been driven to the left and front, and very much flattened, so as to present the appearance shown in the accompanying section, made by the draughtsman of the Messrs. Norris. The body of the conductor, who, when the engine left Reading, was sitting upon the sand-box, which is on top of the boiler, and just behind the smoke-pipe, was found lying close upon the east side of the track, at a distance of three hundred and twenty-six feet forward, or northward, of the point of explosion; one of the firemen was found upon the track, at a distance of one hundred and fifty-five feet northward; the body of another fireman was found twenty feet to the south-west; and that of Mr. Ward, the engineer, at a distance of fifty-four feet to the south-east of the position of the engine.



The tender was found scarcely damaged, and *with the water turned on to both of the engine pumps.* The condition of the boiler gave signal evidence of the energy of the force which had caused the accident. The crown of the fire-box had been torn off just inside of its edges, and outside of the ends of the bridge-bars: this rupture appears to have taken place instantaneously all around, except at one point, where the iron had resisted sufficiently long to twist, or fold, the crown at right angles as it fell, so that the bridge-bars were seen, by looking in through the fire doors, in a vertical, instead of a horizontal, position. These bridge-bars, which, as before stated, were of cast-iron, and had a cross section of three and three-fourths inches, by one and seven-sixteenths inch, had broken off at the stay-bolts, and never at the bolt in the middle of the bar, but always at the first, or second, bolt from the ends.

The violence with which the crown was driven down, is indicated by the fact of a rupture of the iron of the front of the fire-box, evidently caused by a fragment of one of the bridge-bars being driven through it from within. (Below this, and to the right of it, another rupture exists in the outer shell of the boiler; the force which produced this has evidently acted from without inwards, and it doubtless was caused by the fall, as it exists in that part which first struck the ground.) The rivets by which the plates of the fire-box were connected, are cut off as smoothly as wax would be by a pen-knife, and this is the case also with some of the screw-bolts, by which the foot-board was suspended from the boiler; the copper tubes, or flues, of the boiler were good, with the exception of one, or two, which had been bent, and slightly broken at the fire-box end, and the existence of a slight incrustation upon them, showed that they had not, at least for any length of time, been heated to a temperature much above that usual in a locomotive boiler.

The cylinders and accompanying valves were still good; the framing of the engine, and the stays, or knees, by which it was supported upon the frame, were broken, and the connexions of the engine broken and twisted exceedingly. The ash-pan had been driven down upon the track with such force as to mould itself over one of the sills of the road, whilst its upper surface was marked by the indentations made by the grate-bars when driven down upon it. The foot-board was also much torn by the violence with which it had been driven downwards. The rails of the track, upon which the engine was running, were spread outward; the rails of the opposite track were broken in two places; the leading wheels of the engine are marked each by a deep cut in the flange, and one had a portion of its tyre cut out as though by a plane.

In reference to the quality of the materials of which the engine was made:—

As the outer shell of the boiler had suffered no fracture, except where it was battered and ruptured by the fall, the committee had no hesitation in assuming both its materials and its construction to be good. The iron of the fire-box was found to be very much laminated, dividing into four, or five, distinct and entirely separate layers, as the accompanying specimens will show. The fractures of the pieces broken by the committee, were not indicative of an excellent material, but as we possessed the means of ascertaining the actual tensile strength, we were, of course, not satisfied without submitting it to that test. Accordingly, four pieces were taken from the crown sheet of the fire-box immediately along side of the line of fracture, two of which were cut in the direction of the grain of the iron, and two against it. These pieces were reduced, by filing, to a proper cross section, and placed in the apparatus belonging to the Franklin Institute, when the breaking weights were found to be as follows:—

No. 1,	Across the grain,	Breaking weight	51.120	lbs. pr. sq. in.
No. 2,		"	55.320	" "
No. 3,	With the grain,	"	50.280	" "
No. 4,		"	51.120	" "
Average of No. 1, and No. 2,		"	53.220	" "
" No. 3, and No. 4,		"	50.700	" "
" the four pieces,		"	51.860	" "

The fracture in each case was fibrous, (the weight having been applied very gradually,) but it was dull. It will be observed, that since the rupture took place, in the short space between the bend of the edge of the plate, and the ends of the bridge-bars, the iron was not, in fact, subjected to a force in the direction of its length, but to a twist and cross strain, which might cause it to yield to a less force than that stated above. Two other pieces of the iron, in the possession of the Messrs. Norris, have suffered themselves to be bent double, the one while hot, and the other when cold, without indicating any signs of fracture.

The bridge-bars, by which the crown of the fire-box was supported, were made of cast-iron, and had a cross section (as before stated,) of

3¾ inches by $1\frac{7}{8} = 5.4$ square inches; but this cross section was somewhat diminished at the stay-bolts, at which they broke. They had a span of forty inches, and were slightly arched, and their operation would, in consequence, be to transfer the whole strain upon the upper surface of the fire-box, to the points at which they rested upon the crown. The iron of which they were made, was, as will be seen by the specimens, very soft, and dark gray.

The committee believe, from the fact, that not a single portion of the joints had given way, except where the rivets had been shorn off by the lateral expansion, and from the general appearance of the remains of the engine, when examined, that it will, on all hands, be admitted, that the workmanship of the boiler was such as to sustain the reputation which the Messrs. Norris have acquired in their business; and it is evident that the experiments, cited above, refute any supposition of insufficient strength in the crown plate—the laminated structure of which is one of those contingencies, against which the most careful precautions are not always sufficient to guard.

It is not then to weakness of materials, or defects in the manufacture of the boiler, that we are to look for the cause of this explosion: the committee believe that the strength of the engine would have proved adequate to any working pressure which could have been placed upon it.

On the other hand, the engineer, Mr. Joseph Ward, was reputed one of the most capable and trustworthy upon the road, and his character for carefulness and sobriety was such as to forbid the suspicion of any improper tampering with the valves: we have besides evidence that the valves were free.

The whole results of the explosion moreover seem to indicate, not the slow and gradual rise of the pressure of the steam to a force which the engine was unable to bear—a force, be it remarked, not easily obtained upon a well built engine while in motion—but rather the action of a force of great intensity, and generated with such explosive suddenness as to render the safety valves and cylinders of the engine useless as means for giving it vent.

In the first accounts of this explosion much stress was laid upon the fact of its having occurred during a thunder-storm, and the agency in the accident has been attributed to electricity; but in what manner it may be conceived to have acted; whether by heating the boiler, or the steam, within it, or in what other way it increased the tension of the steam, or diminished the strength of the material, the committee cannot conjecture. If there are any experiments, or observations, on record, tending to show the power of electricity to produce such effects in a good continuous conductor, as a locomotive engine, running too, be it observed, upon a wet rail, the committee are in ignorance of them; and, independently of this, the evidence to the contrary is as plain as could be desired.

In the testimony before the coroner, two of the brakesmen, Powell and Cowden, declare that they saw lightning previous to the explosion: Powell says,—"I saw a flash of lightning previous to the explosion, but I could very easily see between the flash and the explo-

sion." Cowden says,—"I saw several flashes of lightning previous to the explosion." Neither say any thing of the nature, or the nearness, of the flash, nor do they seem to have attributed to it any agency in the explosion. On the other hand, two other brakesmen, McGuire and Smith, declare that they saw no lightning, and heard no thunder, which is scarcely reconcilable with the supposition of lightning striking the boiler. Messrs. Weber and Shipp, persons residing near the place of accident, both of whom saw the explosion, agree likewise in the statement that there was no lightning at the time.

In the testimony collected by the committee, it will be found that the storm, which (as is most commonly the case with our thunder storms,) had come from the north-west, had passed off to the south-east, and was almost entirely over before the Richmond had left Reading, so that Mr. Ward had laid aside his outer coat. Mr. Spayd also asserts with confidence, that for some hours previous to, and after, the explosion, there was no lightning to the north of Reading; he heard the explosion, and is sure there was no flash at the same moment. Messrs. Hiester, Herbst, Richardson, and Gruber, all testify to the same absence of lightning. The evidence, therefore, alone is perfectly conclusive, that the explosion was not due to the fact of the engine being struck with lightning.

But there is another cause, which, if we can suppose it to have been in action, is quite sufficient to account for all the effects observed. We allude to the rapid generation of steam of enormous tension, when water is suddenly brought into contact with a part of the boiler unduly heated. The agency of this cause is now so well understood, and its circumstances have already been so carefully investigated by a committee of the Franklin Institute, that we need say no more upon the subject, but proceed to inquire whether such a cause can be supposed to have acted in the present case.

It may be admitted that when the Richmond reached Reading at 7h 18m. P. M., the boiler was filled with water as far as the upper cock, which would give about thirty cubic feet of water above a plane one inch below the crown of the fire-box: (the length of the cylindrical part of the boiler is nine feet six inches, and the crown of the fire-box is eleven inches below this line.) And the evaporation of the Richmond, as calculated by the Messrs. Norris, from the dimensions of its cylinders, is 525 gallons, = 84.24 cubical feet per hour, when running ten miles per hour, with steam of one hundred pounds. To this may be added, according to the opinion of Mr. Kirk, who has great practical experience in these matters, at least fifteen per cent. additional, owing to the condition of the rails, and some additional quantity for the blowing off from the safety valves.

In fact, a carefully conducted series of experiments, upon a very similar engine, tried and recorded long before this accident happened, gave eighty-seven cubic feet as a minimum, and one hundred and thirty-three cubic feet as a maximum, evaporation per hour. While the average of a very extensive series of experiments, made by Mr. Nicolls, the superintendent of the road, with a number of different engines, while they vary very much from engine to engine, give

about one hundred and fifteen cubical feet per hour for engines running at ten miles per hour.

As the Richmond seems to have been engaged in shifting cars for about fifteen minutes before its start, and as the explosion took place about fifteen minutes after it left the depot, the very lowest of these estimates show that its evaporative power was amply sufficient to have reduced the water below the crown of the fire-box, provided the pumps did not work.

What then was the condition of the pumps? It will be recollected that the pumps are beneath the cylinder, and that the pipe leading from the supply valves to the boiler passes between the cylinder and the boiler. All these arrangements are avowedly made for the purpose of keeping the pumps warm when in danger of freezing in cold weather.

That the pumps actually did not work perfectly, there is abundant proof. Thus Mr. Kirk, foreman of the Reading workshops, and Mr. Loeser, a clerk at the depot, both testify that Mr. Ward had several times told them that the pumps did not work well, and that they had given him much trouble.

Mr. Yeager, the engineer of the freight train, which was immediately behind the Richmond when she exploded, testifies to Mr. McCabe's (the conductor's) statement, as to the cause of delay on the Saturday preceding, at the Manayunk tunnel, to which Patrick Nugent, a brakesman upon the train, also testifies; this is, moreover, confirmed by the statement of Mr. Simpson, at the time foreman of the workshops at Richmond, to one of the committee, that he did not see Mr. Ward upon Saturday evening, but that upon inquiring of another engineer, whose train had been behind, as to the cause of the detention, was told that the pumps of the Richmond had given out, and that Ward had to take them to pieces.

Mr. Day, also an engineer upon the road, testifies that Mr. Ward told him, some day of the week preceding the accident, "that his pumps worked badly, and that he never could start them without first unscrewing them, and lifting the caps." He also testifies that he passed the Richmond at Pottsville, upon the day of the accident, that Ward was then just starting, and was engaged in unscrewing the cap of his pump in order to make it work.

Now all those who saw the explosion testify that the engine was running under a heavy head of steam.

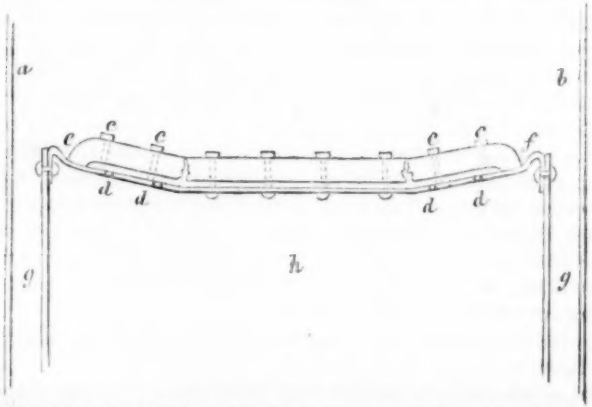
Cowden, a brakesman, testifies that "she had a great head of steam, and was blowing it off at the time." Weber, who was standing in his porch says, that "although not very familiar with engines, he could easily perceive that she was working differently from what engines generally work; that she had a very heavy head of steam, and was going fast, and that she appeared to him like an engine trying to go faster than she was able." Mr. Herbst declares that there was a heavy head of steam; and Mr. Gruber, who was standing with him, says that it "had high steam, was making a great noise, and was running faster than he ever saw a coal train go before." Now all this is easily accounted for, if we suppose that, the night

being exceedingly dark, when starting from Reading, Mr. Ward could not tell whether, or not, his pump was in action, the try-cock being nearly the length of the engine from him, and the noise of the empty cars behind him preventing him from hearing the escape. The great increase of the head of steam would at length give him notice, although not until the water had sunk considerably in the boiler. If then he threw on the other pump, and this acted properly, he should have a sheet of water suddenly rising, upon the overheated surface of the crown-plate, and a condition of things existing exactly such as to give rise to a terrible and inevitable explosion.*

This view of the case seems, in the opinion of your committee, to be pointed out by all the circumstances, and suffices to account for all the phenomena which accompanied the explosion.†

The committee, therefore, report that, in their opinion, the explosion of the locomotive Richmond was probably caused by the sudden rise of water over the crown-plate of its fire-box, which had been laid bare by the defective action of the pumps, and had become unduly heated.

NOTE.—Since the above report was finished, the committee have had the opportunity, owing to the kindness of Mr. Nicolls and Mr. Baldwin, to see the result of a very similar accident, which occurred upon the Reading Railroad, in an engine built by the latter gentleman. The "Hudson" was about the same weight as the Richmond;



a b, the interior of the steam dome; *c c*, bolts of which the lower parts were sheared off; *d d*, holes left open by the shearing off referred to; *e f*, cast-iron bridge-bars as broken; *g g*, water legs, or sides, of fire-box; *h*, the fire-box.

* The shortness of the bridge-bars would evidently transfer this strain from the surface of the crown plate to the points in which they rested upon it, and thus determine the line of the rupture.

† In this connexion it is not to be forgotten that when found, the water was turned on to both the pump pipes of the tender, whereas, it appears, from the testimony of Mr. Kirk, and is well known to all conversant with engines, that one pump, when in action, is more than sufficient to supply the water evaporated.

the bridge-bars were also of cast-iron, but were of greater cross section, and of a less span. This engine, in the absence of her own engineer, was entrusted to one who proved to be not sufficiently cautious, and was left standing upon the track with her valves screwed down "home," and the fire-doors closed, during some detention upon the road. In this case the pressure of the steam broke the cast-iron bridge-bars, and discharged itself by the openings of the stay-bolts, which were driven out, into the fire. The crown-plate of the fire-box was not broken, but was bent inwards to a depth in the centre of five inches.

In this case we see the undoubted agency of steam alone, and the insufficiency of cast-iron as a material for the bridge-bars, while the difference in the intensity of the explosions teaches us the distinction between the effect of a pressure gradually becoming too great for the resistance of the materials, and that of an almost explosive force suddenly generated by water brought in contact and under pressure with highly heated metal.*

The committee have thus ended the task which was entrusted to them, and here perhaps the report should conclude; but we cannot rest satisfied without an endeavor to call the attention of the public to a few points, which, during this investigation, have come prominently under their notice.

In the first place, permit us to draw attention to the total inefficiency of our present system of coroner's inquests. There can be no doubt that had the examination, in this case, been properly and efficiently conducted, much important information upon the subject would have been elicited. which is now forever lost, and much trouble and labor saved in the endeavor to investigate the causes of the explosion; but this subject is without the legitimate province of the Institute, and we pass it with bare notice, to refer to two other points which are entirely within the scope of our powers. In the first place, it has been brought prominently under the notice of your committee, that in consequence of the narrowness of the water-spaces between the fire-box and the outer shell of the boiler, the large engines foam so much, especially when new, that every cock in the upper part of the boiler will indicate water, while the water-spaces are filled with dry steam. In this case the gauge-cocks become worse than useless; they are actually deceptive, while the dangerous state of things around the fire-box requires no comment. Surely our ingenious mechanics will not be at a loss to contrive a remedy for this defect; and, in view of this, the committee would respectfully invite their attention to the new form of boiler devised by Mr. Johnston, and described in the "*Practical Mechanic and Engineers' Magazine*," vol. ii, p. 407, (September 14th, 1844,) which involves a principle, as

* Since the occurrence of the partial explosion above referred to, we learn with pleasure, that Baldwin & Whitney have returned to their original mode of forming the bridge bars of *wrought-iron* of suitable dimensions, which, from considerations of economy, they had only abandoned in a few locomotives, after the experiments of other manufacturers with *cast iron* bridge bars had apparently shown them to be safe.

it appears to the committee, perfectly fitted to meet the case, especially if the pumps can be made to supply the cold water near the fire-box.

The other and last point to which your committee would desire to call attention, is the insufficiency of cast-iron as a material for the bridge-bars, by which the crown of the fire-box is sustained. We are aware that they are not peculiar to any of our manufacturers, but that they have been adopted by more than one of our very best establishments. Their economy is the only excuse alleged in their favor; but though the committee would be sorry to be the cause of increasing, in any degree, the expense of these now almost indispensable machines, they must decidedly protest against weighing a trifling reduction of price in the scale, with the vastly increased risk of life to the engineer and firemen. The committee are glad to learn indirectly, that the officers of the Reading Railroad have already ordered all the cast-iron bridge-bars, in the engines upon their road, to be replaced by others of wrought-iron; and they confidently hope that their example will be followed by other roads, and by all manufacturers, until the very memory of the error shall be obliterated.

By order of the Committee,

WILLIAM HAMILTON, Actuary.

Read October 10; *Adopted November* 14, 1844.

Questions upon the Explosion of the "Richmond."

1. How long had the Richmond been on the road before it was removed? what maximum load had it carried, and what pressure of steam had it borne?

2. What was the exact objection to the engine, for which it was withdrawn? where was it altered, and how long was it before it again came upon the road?

3. How many trips had the engine made after it was replaced upon the road, before the one during which the explosion occurred? what were its loads, and what pressure of steam had it borne?

4. Had any thing peculiar been remarked in the working of the engine, and if so what?

5. Was there any limit to the pressure to which the safety-valves could be screwed down?

6. At what hour did the engine reach Reading on the evening of the explosion? and what was the state of its steam, and the height of the water in the boiler when it arrived?

7. Did the engine take in fuel and water (or either,) at Reading? and what kind of fuel did the engine use? was a fan of any kind used to increase the draft?

8. How long was the engine detained at the depot? were the fire-doors open during this time, and was the steam blowing off?

9. Was the engine detained after leaving the depot, and if so, how long? what was the state of its fires and its steam during this time? what was the pressure of steam?

10. How long, after finally leaving Reading, was it before the explosion took place? and how far was the engine then from Reading?

How was the moment of the explosion determined? was it heard at Reading, or elsewhere?

11. What was the distance, and what the direction in which the boiler was thrown? and the distances and directions in which the bodies of the men killed, and the fragments of the engine were found? what was the position of the boiler when found?

12. Was any injury done to the track by which any idea of the force of the explosion can be formed?

13. What is the grade at the point where the explosion occurred? Is the road there curved, or straight? and, if curved, to what radius?

14. What load was the engine drawing when it finally left Reading? and how was it placed in the train?

15. To what pressure was the forward safety-valve adjusted? Is it known whether it worked freely in its seat?

16. What testimony can be procured from the brakesmen, or from the engineers of trains near, or from other persons, in reference to the circumstances accompanying the explosion?

17. Was there another train ahead of the Richmond? if so, with what speed was it running?

18. What were the facts in reference to the thunder-storm? did the explosion coincide in time with a flash of lightning, or had not the thunder commenced, or had it ceased, at the time of the explosion?

19. Please to procure a copy of all the evidence before the coroner's jury.

And, in fine, the committee will feel themselves under obligation to any person for any information which may tend to throw light upon the cause of this disastrous accident.

Answers to Questions on the Explosion of the "Richmond."

1. Made first trip August 14; exploded September 2; 765 tons on a level; *supposed* 150 pounds.

2. Valve rod of new "cut-off gearing" too light; rod reaching from rock shaft to steam chest; altered at Messrs. Norris' works, Philadelphia, in four days.

3. Eight, four of 605 tons *down*, and four of 232 tons *up* the road, including coal and cars; *supposed* 120 pounds.

4. Yes: the pumps gave even more trouble than usual with a new engine; the tender pulling-bar broke, and the boiler blow-off-cock, when opened, could not be shut.

5. No: all of "Salter's" safety valves may be screwed down perfectly tight.

6. 7h. 18m. P. M.; steam low, valves not blowing off, and water high in the boiler; the evidence on this point is strongly circumstantial, not *positive*.

7. Both; white oak; no, the exhaust only.

8. Sixty-seven minutes; the fire-doors were not *observed* to be open; both valves were blowing off gently when the engine left.

9. No: except by passing slowly up the Main street of Reading; say four, or five, miles per hour for one-fourth mile; answered by No. 8.

10. Fifteen minutes; 2.02 miles; by the fixed hands of a watch in the conductor's pocket, which stopped at 8h. 40m. P. M.; not heard at Reading.

11. Suppose engine going due north; boiler thrown north-west 249 feet, conductor due north 326 feet, engineer south-east 54 feet, one fireman due north 155 feet, and the other fireman south-west 20 feet; fragments of engine scattered all around the spot of explosion; boiler lay 78 feet due west of track, and its axis about parallel with the rails.

12. The rails of the track on which the engine ran were much spread and deranged; the rails of the opposite track (double track) were broken in two places.

13. Six feet per mile, ascending; straight where engine exploded; her train lay in a curve of 3000 feet radius.

14. The engine was hauling a train of eighty-eight empty coal cars, weighing 211 tons.

15. About 120 pounds per square inch; it did.

16. The brakeman next the engine, 150 feet from her, states that he heard a sudden explosion "like a quarry blast," and that immediately the train stopped, and the cars began to pile, or rise, one over another; he is sure he saw no lightning, or heard no thunder.

17. A train left Reading one hour before the Richmond, and ran from ten to fourteen miles per hour up the road.

18. Answered in No. 16; some farmers in the neighborhood saw the explosion, but saw no lightning, nor heard any thunder; it thundered and lightened considerably before the accident, and but little after it.

Depositions of Witnesses taken before the Coroner.

Patrick McGuire, sworn.—I have been on train; saw no lightning, or thunder, at the time of the explosion; felt no shock before the report; Joseph Ward, engineer.

Matthew Smith, sworn.—I saw no lightning, or thunder, at the time of explosion; it reported as loud as a cannon.

J. S. Weber, sworn.—I live about three-fourths of a mile off from the place; I remarked to my wife they are coming with too much steam; and when the explosion took place it caused darkness; but before it was light by the sparks.

Daniel Shipp, sworn.—I was on my porch; I then remarked to my wife the cars are coming; saw no lightning at the time, or thunder, in Alsace township, county of Berks, and am satisfied that it was an explosion of the boiler.

John W. Powell sworn, brakesman.—Left Reading at about eight o'clock; when standing on my post, I saw a flash of lightning and thunder previous to the explosion, but I could very easily distinguish them, or see between the flash and the explosion of the boiler.

Thomas Cowders, sworn.—Last evening McCabe requested me to come on as brakesman on the train at about eight o'clock, or quar-

ter after eight o'clock; I was sitting on the car next to the engine; I saw several flashes of lightning and thunder previous to the explosion; she had a great head of steam at the time, and blowing it off; I saw them lying there dead, and often saw Joseph Ward, and that they came to their deaths by the explosion of the boiler of the engine named Richmond.

Testimony before the Committee.

On examination by me of witnesses conversant with the circumstances attending the explosion of the Richmond engine, the following statements were given by—

Mr. Kirk, foreman of the Reading workshops.—Mr. Ward had complained to him several times, that his pumps worked badly, and had given him much trouble; one pump, if it works well, is, under ordinary circumstances, more than sufficient to supply an engine with water. The storm of the 2d of September, the day on which the Richmond exploded, came from the north-west, and had passed off to the south-east, and almost entirely ceased at Reading when the Richmond left, so much so, that he had laid aside his umbrella, although it still rained slightly. The engine was not blowing off when she arrived, but did not notice if she was, or was not, when she left; was at the depot some time after; heard but little thunder, and but few and indistinct flashes of lightning to the south south-east. From the rails being wet, thinks engine would use about fifteen, or twenty, per cent. more steam than with a dry rail; lower cock about five inches above top of the fire-box; upper tube two inches below.

T. Loeser, clerk at depot.—Mr. Ward complained to him on several trips, that his pumps worked badly, and gave him much trouble.

—— *Rigg*, assistant clerk.—Was at depot taking account of cars; the rain had almost ceased when Richmond left; Ward had taken off his oil cloth overcoat; heard but very little thunder; took no notice of the state of the steam.

Philip Albright, depot hand.—Left the depot soon after the Richmond; as he was going to bed, about twenty minutes after nine, his wife, who was looking out of the window in the direction in which the engine was going, called him to look at a strange light, saying that it did not look like lightning, as it was all in one spot; she heard an explosion before he got to the window; he did not, nor did he see any light.

Joseph Spayd, of Reading—Says he is pretty sure that during the whole storm there was no lightning to the north of Reading, and is certain there was none in that direction for some hours previous to and after the explosion; he is sure of it, as he watched it, and took particular notice of it at the time; a few minutes after nine he was standing, together with several other gentlemen, on the steps of Mr. Kendal's hotel, in Reading; he saw a flash of lightning, and heard the thunder; it was far to the south-east; some ten, or twelve, minutes after, heard a report to the north; he, and those standing round, remarked that it was strange, and wondered what it could be, as it did not sound at all like thunder, but the report of a cannon; and that there was no lightning, he is himself certain there was none.

John Day, engineer.—Was at Richmond on the Sunday of the week previous to the explosion; the Richmond engine was then standing, with her boiler full of water, and no fire in her; he looked into the fire-box, and saw water running through the crown; called Mr. Ward, and both supposing it to come through a bolt hole, neither examined it particularly. Some day during the same week, Ward told him his pumps worked badly, and that he never could start them without first unscrewing and lifting the caps; he passed the Richmond on the trip up, on the 2d of September, at Pottstown; Ward was then just starting, and was engaged unscrewing the cap of his pump, in order to make it work; the Richmond worked harder, that is, made a louder exhaust, than any engine on the line, or any he ever saw; thinks it was owing to her exhaust pipes being too small.

T. Yeager, engineer of freight train behind Richmond—When she left she was blowing off at both valves, but not very hard; did not see Ward try either his gauge-cock, or his try-cock; was a short distance behind the Richmond when she exploded; heard the report, but it did not sound very loud; cannot say that he saw any light of any kind; it had lightened before, and did soon after; Mr. McCabe, the conductor of the Richmond, told him at Reading, a few minutes before starting, that on his trip down, the Saturday previous, he had been delayed about a half an hour at Manayunk tunnel, while Ward took his pumps apart, as they had given out, and refused to act.

Patrick Nugent, brakeman on the Richmond—Was sitting in about the twelfth car from the engine, with his head down; the explosion sounded like a cannon, or a quarry blast; no light was produced by it, nor was there any lightning at the time; there had been some a short time before, and was some after; did not see if steam was blowing off, or not; did not notice it at Reading; the train was delayed near Manayunk, on its trip down on Saturday, about half an hour; he did not know the cause of it at the time, but was told next morning by one of the firemen, that the pumps had given out, and that they had been obliged to stop and fix them.

T. J. Weber, schoolmaster.—Lives from one-eighth to one-fourth of a mile to the right of the road, at the point where the engine exploded; he and his wife came out in front of his house a little while after nine, to see if they would be likely to have more rain, as it had almost ceased at that time; he says he saw the engine come out of the cut; that, although he is not very familiar with engines, he could easily perceive she was working very differently from the manner in which engines usually work; that she had a very heavy head of steam on, and was going fast; that she appeared to him like an engine trying to go faster than she was able; and that she was throwing out more sparks than he had ever seen before; it was so dark he could not see the men upon the engine, nor the escape of the steam from her valves, the only thing he could see was the sparks; he remarked to his wife that the engineer was in great danger of bursting his boiler; a moment after she exploded; he was looking at her at the time; the report was like that of a heavy piece of ordnance; there was no thunder, or lightning, nor light of any kind produced; the report

did not sound like thunder; the explosion produced no luminous appearance; the light of the sparks was instantly extinguished, and immediately after he heard the report; the thunder and lightning before and after the explosion, was to the south, and distant; there was but little after, and one clap some five or ten minutes before.

Mr. A. Hiester.—Lives about one-eighth of a mile to the right of the road at the point, when the engine exploded; was sitting in his room at the time; heard the noise of the cars approaching, and then the report of the explosion; sprang up thinking for the instant, from its sharpness and nearness, that his barn was struck with lightning; said so to Mrs. Hiester, but she replied no, that it did not sound like thunder, and that there was no lightning; but that she thought it must be an accident upon the road; Mr. H. is himself certain that there was no lightning, or light of any kind, at the time; saw some lightning to the north sometime after the explosion, not in flashes, but very faint summer sheet lightning.

William Herbst, farmer.—Was standing on Mr. Hiester's porch, together with Moses Gruber, and Reuben Richardson; saw the engine approaching with heavy head of steam; could not see if she was blowing off; was looking at her when she exploded; heard the report which sounded like a big cannon; there was no lightning, and no light produced by the explosion, but the light of the sparks was instantly extinguished; the report did not sound like thunder; there was no lightning for some time before the explosion, and that was distant, and to the south, or south-east, and but little after, and that also to the south and south-east.

—— *Richardson.*—Had just gone up stairs to go to bed; heard the report; it sounded like a cannon; is positive there was no lightning.

Moses Gruber.—Was standing on the porch with Reuben Richardson, and William Herbst; saw the engine coming; had high steam; was making a great noise; and was running faster than he ever saw a coal train go before; could see nothing but the sparks; does not know if she was blowing off, or not; could not see; was looking at the engine at the time she exploded; there was no lightning, or any thing like it; the light from the sparks, which was all he could see, was, at the moment of the explosion, instantly extinguished; he could see nothing further; the report was like that of a cannon.

Reuben Richardson—Testifies the same as the above.

The above is a correct statement of the testimony taken by me from the persons whose names are prefixed to their declarations.

ROBERT FRAZER.

Explosion of the Boiler and Steam Chimney of the Portsmouth.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, to whom was referred for examination the cause of the Explosion of the Boiler and Steam Chimney of the Steamboat Portsmouth, on the river Delaware, REPORT:—

That they have carefully examined the boiler and steam chimney

of the Portsmouth, and obtained all the information necessary to a correct determination of the causes of the explosion. This event occurred on the —— August, 1844, on the Delaware, opposite to High street, within two or three minutes after the engine had commenced working, and about one minute after the blowers (which were driven by a separate engine,) were in motion. The interior cylinder of the steam chimney was rent at the part where it united with the boiler, and, in fact, formed a portion of *its* interior shell: as the exterior cylinder of the steam chimney was discontinued at this point, (as is usual, for the purpose of forming a passage for the steam,) *a large surface existed wholly unsupported by stays*, which elsewhere strengthened the chimney. If stays had been provided at this point it would have been necessary to attach them from the remote end of the boiler. The rent sheet, which, at this exposed position, should have been made of *very thick* plate,* was originally too thin, and had become still further reduced by exfoliation, caused by the fire acting on it on one side, whilst the steam—a bad conductor, corroded the other. The sheet was in some places reduced to a thickness of only one-tenth of an inch. The corrosion and exfoliation at this exposed point, were increased by the relative position of the draft doors, one of which, owing to a defect in the latch, could not be kept perfectly closed. The air rushing through the crevice deflected the flame, (which was still further heightened by this additional supply of fresh air,) against the sheet which was rent. *According to the testimony of Captain Devoe*, who voluntarily appeared before the committee, and answered their inquiries with great ingenuousness: "the boiler had borne a pressure of twenty-seven inches of steam in his presence on the Hudson river, in New York, before he purchased the boat, about the 24th of July, 1844. The hull of the vessel was two or three years old; the boiler more than six." As the rent did not occur in the boiler, however, but in the steam chimney, the age of the boiler proper is immaterial in this investigation. "The water was found to be ample by the captain seven or eight minutes before the accident, coming from the third cock. The pressure of the steam was seventeen inches only, according to the declarations of the engineer, on his death bed, made to Captain Devoe."

From this statement of facts the causes of the explosion are manifestly the following:—

1st. The original deficiency in thickness of the rent sheet, which was yet further reduced by the chemical action of the steam, and by exfoliation caused by the fire.

2d. The absence of stays at this part.

The construction and management of steam engines are now so well understood, that the term accidents, as explosions are usually called, should no longer have a place in our vocabulary: when they occur they are always the result of carelessness, and may always be prevented by reasonable precautions.

* The inside diameter of the steam chimney was four feet four inches; as the pressure of the steam was against the *external* surface of a cylinder, the usual strength of the cylindrical form, so well adapted to resist internal pressure, was, of course, absent.

As no evidence has been submitted to the committee, that any undue pressure had been employed on board the Portsmouth, it is manifest that the steam chimney was defective long prior to the time of the explosion; it appears to the committee that the certificate of the inspector at the port of New York, (a copy of which is herewith submitted,) was not founded on a careful and accurate examination. Captain Devoe, relying on such certificate as corroborating his inquiries made previously, purchased the steamboat as safe and trustworthy. The lamentable loss of life, which has created such consternation in this city, where such events are nearly unprecedented, *cannot be attributed to his negligence.*

The use of steam chimneys being very common in this country, and numerous explosions and collapses having occurred from their use, the committee would again earnestly solicit the attention of the public to them. Were they made of suitable materials and dimensions, and carefully stayed, as they are manifestly useful in surcharging and drying the steam, they may be safely and advantageously employed; but they require *frequent and very careful* examination, and should always be made of very thick plates. These precautions are absolutely indispensable, when blowers are used for increasing the intensity of the heat; and particularly so when the latter are resorted to, to ensure a sufficient supply of steam from a boiler otherwise too limited in its dimensions to produce it. The temptation to make light and small boilers for steamboats, and to remedy the deficiency of boiler surface by blowers, is lamentably frequent on our waters, and unless a system of more frequent and careful examination could be instituted and enforced by penalties rigorously exacted, than the present law of inspection relating to steam vessels exhibits, in practice, it would be advisable to forego the use of this very common apparatus in steamboats, the steam chimney, rather than to be constantly exposed to risk from this, the weakest, the most dangerous, part of the boiler; a part moreover where danger may *sometimes* exist wholly unsuspected even by a careful observer.

The committee, in concluding this report, avail themselves of the occasion to request the attention of the constituted authorities to the manner in which coroner's inquests are usually conducted in this country, when an investigation of the causes of death should be conducted with all the intelligence which is applicable to the case. In England, from which we have derived this institution, whenever an explosion occurs attended with loss of life, every available source of information is resorted to; days and weeks, and even months, in extreme cases, are devoted to the examination of witnesses, to obtaining the opinions of scientific men of acknowledged eminence which may shed light on any department of the subject of inquiry. The evidence, at length, is published in the daily journals, and frequently commented on, from time to time, during the investigation. The public is thus aware of what occurs, and new witnesses and more opinions of scientific men are obtained. If no negligence is imputed in the verdict of the jury, the public can place a reasonable reliance on the conclusion; if otherwise, a deodand, or fine, stamps, in charac-

ters as legible as durable, the condemnation of the cause of injury. It is needless to remark how different the system is in this country; how deplorable the remissness of juries, and the apathy of an injured, a defenceless, but too patient, and long suffering public, whom the newspapers almost invariably endeavor to assure that no blame can possibly be attributed to any of the parties concerned.

By order of the Committee,

WILLIAM HAMILTON, Actuary.

Philadelphia, November 14th, 1844.

Address delivered by FREDERICK FRALEY, ESQ., *at the close of the Fourteenth Exhibition of American Manufactures, held by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, October,* 1844.

We are about to close this display of the products of the skill and industry of our fellow citizens, and the occasion may appropriately be improved by some considerations which naturally force themselves on the mind on such an event. The history of the useful arts is the history of man in his civilized state. In whatever direction we turn our eyes, this truth is most emphatically exhibited, and all the discoveries of modern times bear their testimony to its correctness. If we search the ruins of Egypt, or the more imperfect memorials of western Asia; if we explore the hitherto almost untrodden wilds of America; or if we study the history of man as recorded in sacred and profane history, we find that just in proportion as he has put on the habits of civilized life, the comforts bestowed by the useful arts attend his path, and fit him to tread it under those feelings which connects him most closely with the great Author of his being. Man may be appropriately described as the creature of wants; his mind even in its most uncultivated state, cannot remain in a state of inactivity; it must either be at work for the elevation of the individual, or for the benefit of the race.

The pursuits of the wandering savage are too closely connected with the selfish feeling of the individual, to enable him to carry himself beyond the dominion of such an influence; but when even the savage, from the pressure of external and accidental circumstances, is compelled to remain stationary for a very limited period, he becomes a creature of wants; and the natural tendencies of his mind labors to supply them. Alone, or merely attended by his faithful helpmate, the shades of the forest protect their heads from the beating of the storm, or the scorching heat of mid-day. The spoils of the chase yield them food and clothing; the clear stream from the mountain spring slakes their thirst, and the pure breezes from the hill stimulate their appetites, and invigorate their bodies. But once check this wild and roving spirit by the most trivial event; let it be wounds, or sickness, or even the presence of an enemy, that compels man to fix his habitation, and at once the ennobling ends, for which he has been fitted,

bud forth and blossom, and he becomes a new creature. The trees of the forest must be knitted together, and cemented by the soil, to form a permanent dwelling; the skins of the animals slain in the chase must be softened and cured by heat and smoke, so that they will not need perpetual renewal; the fruits of the soil must be collected and garnered up for a constant supply, and the operations of nature must be watched in the recuperation of the animal and vegetable kingdoms; so that the creature hitherto so dependent upon accident and chance may render himself, in a great degree, independent of both. The comforts which centre in a settled home, having been once enjoyed, the influence of example begins to operate, and the hitherto solitary hut becomes the centre of a village; men become individualized in a new aspect; and the division of labor is the necessary fruit of this new change. The isolated man finds that now it is only needful for him to direct his energies to a single pursuit, and as each feels and acts upon this truth, excellence gradually shines forth, at first by an uncertain and often obscured light, but finally in a steady and regular ray. Improvement stretches forward with rapid strides, and at last a degree of perfection is attained which leads man to remodel his first creations; and the monuments which after times display, record but imperfectly the steps by which he has reached the goal.

Such is a brief sketch of the history of man: nation after nation, of whom the record only remains in the majestic pyramid, or the chaste but decayed temple, have run such a course; and as successive generations have appeared upon the great theatre of the world, they have trodden the same path, and each in turn found, when they had almost neared the zenith, that the wise man of inspiration gave utterance to a truth fitted to all times, and all conditions of men, when he proclaimed that there was "nothing new under the sun." But although such is the inevitable law under which man fulfils his destiny here, ought it to induce him to strive against the progress of improvement? Who will not answer most sincerely and decidedly in the negative?

Who would be willing to exchange the comforts, nay luxuries which surround us, attended as they necessarily are by some restraints of personal independence, for the uncontrolled freedom enjoyed by man in his normal condition?

Who would be willing to exchange those intellectual gratifications which are yielded by the poetry, history, statuary, painting, and music, of the refined and cultivated Greeks and Romans, for the strictly sensual gratifications that characterize the wandering and savage nations by whom they were surrounded? Compare the condition of France, Britain, or America, at this day, with that of the nations now covering the soil of Egypt, and western Asia, or even with that of China, whose boastful people connect themselves with the time immediately succeeding the deluge; and how greatly does the former preponderate.

Although their path is not attested by the magnificent piles which, whatever may have been their object, show that millions must have groaned under the toil necessary to erect them; a more benevolent

and catholic spirit has been watching by the way side, and at every step they have made in real civilization, the pulses which have recorded the advance, have successfully thrilled in the veins of class after class, until the humblest individual has known and felt that he had a destiny far above that of the beasts that perish. While in the earlier ages, the possession of knowledge, and power, and wealth, was confined to the kings, and priests, and nobles, the present state of the world exhibits a more general diffusion of those gifts, and the classes of society that were formerly chained to the soil, or still more effectually chained to the will of a despot, now control the destinies of the world, and governments are raised up, or cast down, at their bidding. How important, therefore, it becomes that such a power should be wisely and well directed. Left to the naturally selfish impulses of his nature, man is always striving to elevate himself—educated to the great truth, that he must, in civilized society at least, be, in a great degree, a dependent creature, his selfishness is changed to a new principle, and that principle is to make the country, or the city, in which he lives, greater and more prosperous than those in her neighborhood, or those of foreign and distant parts. As the new principle enlarges, he is willing to extend the circle of his affections and efforts; and finally, in some few things, civilized men of all nations agree to stand on a common ground, and to recognize these common principles as the rules for their international intercourse. The aggregation of the small communities of a country into states and kingdoms, is another consequence of the existence of the principle just referred to; and when society reaches this point, a new development of the principle of the individualization makes its appearance. This is the distinction of intellectual efforts, and it shows itself in a great variety of forms. With some, the examination of the material substance by which they are surrounded, is the ruling spirit—the laws that govern the motions of the sun and planets—the changes produced by the action of air, moisture, and heat—the new and useful products yielded by the combination of one, or more, substances together, occupy the attention of others, and make in the hands of such inquirers the arts and sciences. As the great truths of nature are thus won from her infinite laboratory, the simple generalizations from first experiments yield to the more subtle inquiries of the philosopher; and at every step almost he finds some new lights shed upon his path, so that in the experimental part of physical science, at least, he learns that there is always something beyond his present attainments; and, when that is reached, a still wider and diversified field invites his continued scrutiny. I have indulged in these views of the case from a conviction that there are by far too many who undervalue the inquiries, which, at the present time, occupy so large a share of the attention of men of science. They compare the present with what existed half a century ago; and while they exclaim with delight and wonder at the progress they have witnessed, they forget that even while the burst of gratification is swelling their hearts, some one but a little removed from their stand is already in advance. We find sufficient illustrations of the correctness of the position, in the rapid

communications that now exist between Europe and our country. Although American genius has doubtless contributed her full share to the common stock, how often do we find ourselves outstripped by the use in foreign countries of our own inventions. Sometimes they scarcely allow us to whisper them, before we find them spread upon our tables in the pages of an European periodical, and claimed as of foreign origin; and there is scarcely an American mechanic, or philosopher, who has not experienced this mortifying occurrence. The correction of the evil may be difficult, but it ought to be undertaken; the method of accomplishing it is undoubtedly that which, to some extent, prevails abroad, in the intimate union of the philosopher with the artizan; not so much the existence of the two in the same individual, as that spirit of confidential intercourse between the man of science, and the man of art, as will lead the former to communicate freely what he himself discovers, or what has been discovered by others, and the latter willingly to test the application of these discoveries in the workshop; frankly to acknowledge their advantages, if such be realized, or with equal frankness to state when and how they fail. That such an unison of effort is practicable, we have proof already in numerous instances in our own country, and if we look abroad we find them existing in great numbers in those countries from which we have sprung. Our illustrious countryman, Franklin, whose philosophic mind seems to have had a special mission for the improvement of his race, in his early efforts wrought upon this principle. The foundation of the Junto, the establishment of the American Philosophical Society, and the Philadelphia Library, were the instruments by which he formed the union of science and art in our city, and the honored survivors of these associations still flourish, and attest the wonderful workings of that mind, which, ennobled by the acquisition of knowledge, rose step by step from the shop of the soap boiler to the level of statesmen, and nobles, and kings. The influence exerted upon the society of our metropolis by these institutions, and the general character of Benjamin Franklin, has never passed away: its spirit has caused the city to be renowned for her establishments for education and charity, and here the great work of knitting the boundaries of the nation together by turnpike roads, canals, and railroads, has been early and steadily prosecuted. We may have gone on too rapidly for those who desire to see the usury of their monies annually poured into their coffers, but to those who take in the untold millions of posterity with a present glance, we seem hardly to have done enough. What constitutes now the boast of civilized Europe, —the bloody trophies of unblessed wars, or the soul-satisfying fruits of honorable peace?

Behold the mighty changes that have come over that land since the final overthrow of Napoleon. It may well be doubted whether if the productive industry of those nations had not been doubled and quadrupled within the last thirty years, they would not have fallen into anarchy and ruin by the weight of their war debts. But as the products of the industry of each member of society is increased, the ability of a nation to sustain the pressure of taxation is wonderfully

enlarged, and a national expenditure, which in times of unsettlement and confusion, is almost intolerable, weighs but as a feather in the balance, when the hand of industry is full of work. This consideration naturally leads us to a contemplation of the condition of our own state, and of the institutions that have been established among us for advancing the common welfare. If we survey Pennsylvania according to the physical aspect presented on the map, we are struck with peculiarities not to be found so broadly exhibited in any other state of the Union. This configuration gives to her citizens the choice of a very wide range of pursuits; even should they be confined to the more elementary and pastoral occupations of man. The noble forest inviting the visit of the hunter, or the woodman; the beautiful valley watered by most noble rivers, calling the agriculturist and the shepherd to make it his dwelling place; the broad and even plain looking towards the sea, where a city would rise almost at the first footfall of the white man. But when we add to these the rich treasures that lie beneath the surface, who shall say that our lines have not been cast in pleasant places, and that we have not a fruitful land to dwell in? Our fathers have not left themselves without witnesses, that they understood and valued all these good gifts. Separating themselves from the narrow and sectarian views which at that time, in Europe, were chaining the intellectual and physical energies of man, they gave the widest range for improvement, and it is only necessary to refer you to our colonial history, to prove that here the superstructure was, with few exceptions, in perfect harmony with the foundations, laid with so much wisdom by the mind of William Penn. While a truly watchful and paternal spirit overlooked the people, the interference of government with these pursuits was of rare occurrence; and so watchful have the colonial and state authorities been on the subject of corporations, that until within a few years the creation of any, having for their object the prosecution of branches of manufacturing and mechanical pursuits, have been steadily refused, while those for charitable, literary, or scientific, purposes have been freely established, and liberally endowed out of the common stock. This policy has given us a peculiar character. Our citizens have become successful agriculturists, miners, builders, and mechanics, but they have not been manufacturers in the modern acceptation of that term.

The coal, and iron, and wool, of Pennsylvania have been largely exported to other states, and have been returned here in various manufactured forms, to be sold and distributed by our citizens to our own, and to the people of the neighboring, or distant, states. Far be it from me to desire the existence of a sectional feeling that should prevent our raw materials from filling the workshops and factories of other states; but what I desire is, that our own people should not shut their eyes to the advantages they enjoy, and be willing to profit by them. This profit can only be obtained *by confidence:* the capitalist who allows his money to lie idle, either in his own chest, or places it upon the uncertain tenure of his fears in the vaults of a bank, can scarcely realize the public injury he is thus inflicting. His wealth has been given him for no such purpose; and the retribution will come,

even at the third, or fourth, generation, for his non-application of the means of doing good.

Wealth thus withheld from the uses of society will assuredly perish in the hands that hold it with so close a grasp; but if it be liberally and well directed to the hands that labor, and the heads that teach, it will flow back to the giver abundantly increased, and bring with it the blessings of those whose homes and families it has built up and sustained. Referring here again to the illustrious Franklin, and the broad and liberal forecast of his mind, we are struck with the truth of the maxim of inspiration, "that the liberal man deviseth liberal things." Although he was far from possessing millions, his *will* bears a noble testimony to his ever active and useful mind. In the legacies he bequeathed to the cities of Philadelphia and Boston respectively, he proposed a scheme for the advancement of young mechanics that is not paralleled in our own times. That it has not succeeded according to his calculations, and his hopes, is rather to be attributed to the channels through which the bounty was to pass, than to any error in his theory. There are too many duties pressing upon the time of a public functionary to permit him to attend to a matter of so much detail as the Franklin legacy, and we are to look rather to this cause than to any other, that both in Boston and this city, his objects have not yet been attained. But such failures ought not to deter the hand of liberality from contributions to those institutions, whose organization peculiarly fits them for the advancement of knowledge and industry. And of this class, mechanics' institutions, and apprentices' libraries occupy a prominent place. They take the various industrial arts out of the routine of the mere workshop, and give the artizan the possession of a new and almost infinite power; the power of useful knowledge. The traditions of the shop may, up to a certain point, make a good workman, but how vastly superior is the mechanician whose art is the combined production of well trained practice, and well directed knowledge of the properties and affinities of the substances on which he manipulates. Take, for example, one of the chaste and rich lamps, or candelabra, of our skilful townsman, Cornelius, silvered by the economic application of the new galvanic process, and compare it with the wasteful processes, and clumsy joints made in the best fabrics from European shops less than ten years ago, and our auditors will form some faint notion of what modern science has done for one of the elegant arts.

Or compare the beautiful designs and perfection of colors with which our fine woolen and cotton fabrics are covered by the use of the modern printing machine, with those elaborate but grotesque and heavy productions of the old methods of block printing, and you will acknowledge another important benefit conferred by the scientific skill that has the faculty of readily and simply impressing by unerring machinery the types of so much beauty on the copper roller. Or if we turn our attention to those arts in which heat is the great acting agent, how completely has even that subtle fluid been chained by the hand of science to the economical production of many of the necessaries and luxuries of civilized life.

Let me refer to a single instance of this, in the refining of sugar; fifteen, or twenty, years ago, it was a tedious and uncertain process, only regulated by the supposed skill of the master boiler, and if he were so unfortunate as to fail in bringing out a good article, every other cause than the right one was his apology. Now the application of steam of known tension under the evaporating vessels—the use of a partial vacuum for facilitating the evaporative process, and the conduct of the whole business under the recording of permanent instruments for measuring heat and pressure, in lieu of the eye and hand of the workmen—give a certainty and regularity to the business that enable the manufacturer to sell a better article at a greatly reduced price. I recollect, distinctly, an aged friend of mine telling an anecdote of a celebrated brewer in this city, who believed that his beer would not be good unless it had been stirred with a sassafras stick; and another of a cutler, who supposed he could not produce a good cutting instrument unless his fire had been kindled with the parings of leather from the currier's shop. These, it is true, are extreme cases; but in tracing the history of the arts, we find the sassafras stick, or the leather parings, showing their heads in some form or other, in all of them. Our purpose in these illustrations is to prove not only the advantages conferred by science on the arts, but also the necessity of men of various pursuits combining to establish institutions, in which the sciences, connected with the useful arts, may be taught, and the recorded discoveries made abroad be constantly accessible. Such an institution we have in the Franklin Institute, and such, by the influence of its example, have been rapidly multiplying in the various sections of our country. Its great object is instruction; and for the accomplishment of this, it has established schools, lectures, cabinets of minerals, models, and productions of the arts, a library, a journal, a reading room; and, finally, exhibitions, and committees of science.

To those who are not familiar with its history, the enumeration of these objects may seem rather to savor of vain boasting than of sober and unadorned truth; but to many of my hearers this enumeration conveys but an imperfect outline of the workings of our society.

The establishment of our system of public instruction in the more elementary branches of knowledge, has relieved the Institute from any care on those subjects, and the High School, founded by it, has been discontinued for some years.

The Drawing School, is, however, regularly opened every autumn, and its pupils, in addition to the instruction given therein, are allowed without additional expense, to attend the regular courses of general chemistry, natural philosophy and mechanics, and technology; and when occasional courses are delivered on other subjects, these too are open to them free of charge. The competency of the several gentlemen who fill the professorships is so well attested by the social position they hold among us, that eulogy from me would be entirely superfluous. It is due to them, however, to remark, that independently of the labors of these several chairs, they are also among the most industrious and zealous workmen in the committees that have

charge of the Journal, and of the scientific investigations, and that the pecuniary compensation which the Institute has hitherto been able to allow them, is far below what such services would command as private teachers, or examiners.

The library is now very extensive in books and periodicals connected with the history and progress of the arts and sciences, and a sufficient quantity of belles lettres literature is to be found in this department, for mental relaxation, when the more technical subjects become oppressive. The cabinet of minerals, models, and specimens of arts and manufactures, are steadily increasing, and they would, doubtless, improve more rapidly had the institution the means of more suitably providing for the display of such objects. The Journal has been, for almost twenty years, regularly recording the great discoveries of the day, whether made in this country, or in Europe; and is believed to be the only work now extant containing a list of all the American patents. The investigations in practical science that have been made originally by the Committee on Inventions, and more recently by the Committee on Science and the Arts, are only equalled by the works of commissions which have from time to time been instituted in Europe, and paid for out of the public treasury; while, in our case, the personal services have been entirely gratuitous, and in several matters of great importance in a national point of view, the only aid furnished, either by individuals interested, or the public authorities, has been the necessary outlay for materials, or apparatus. Whenever the Institute has been called upon for information by the municipal, state, or national, governments, the task has been cheerfully undertaken, and faithfully fulfilled; and although the recommendations thus made have been sometimes postponed for a season, they have, in the sequel, generally been put in practice when the routine of old methods had failed to satisfy the demands of the public voice. We forbear, for the present, speaking of the results of our exhibitions, for we desire to pause for a moment to ask at what cost has all this been accomplished.

We cannot, of course, measure the value of the time thus given by any pecuniary standard, but we mean to speak now merely of the amount of money that has been received from members, and in ordinary donations.

The conductors of the richly endowed establishments of Europe, will, no doubt, smile when we tell them that it is less than an average of six thousand dollars a year, or, in other words, that for six cents a week every man in our community may have access to a library and reading room well filled with newspapers from all parts of the Union, with the literary and scientific periodicals of the American and European press; may attend at least sixty lectures annually on the most important branches of physical science; may enrol himself either as a learner, or laborer, on any, or all, of the committees having charge of the cabinets, or of scientific examinations, and if he be willing to pay two cents a week more, he can enable his son, or apprentice, to participate in the principal of these advantages. It is not my province now to ask for aid to keep up our courses of instruction, cabinets,

library, journal, and committees; these, we fear not, will always have the popular sympathies and support; but it is my painful duty to tell you that our Institution is laboring under the weight of a debt contracted under the most flattering hopes, but made a grievous burthen by a disastrous change of times. Anxious to meet the wishes of its members for enlarged accommodations, the Society was induced to purchase a valuable property in the city at what was considered a reasonable price.

Payments to the amount of about forty thousand dollars for account of the principal and interest of the sum thus contracted for had been made, when, owing to our inability to meet the interest, and maintain our organization, we were compelled to give up the property, and sacrifice, totally, this great amount. By the liberality of several of our citizens, we have been released from portions of the indebtedness represented by this loss; but there still remains enough to crush us utterly if we cannot, in some way, obtain the surrender of the certificate of debt. In addition to this, we owe still a part of the debt contracted in the year 1824, for the purchase of the site, and the erection of our Hall, so that with these obligations, our path for the last five years has been beset with difficulty and trouble. A generous, active sympathy, on the part of our members and fellow citizens, would soon relieve us, and we now make an appeal for it. Cannot five hundred men be found in this city and state, who feel a sufficient interest in the success of the Franklin Institute, who are willing to give one hundred dollars each to such an object. Relieved from the pressure of debt, we could repay such an outlay thrice over, by enlarging our plans for giving instruction; and who is there among us, elevated as he may be by the possession of wealth and station, who can look far enough into futurity, to say, neither my son, nor my son's son, will ever be an apprentice, or need the aid of such an institution as our own. The last sixty years have taught us many emphatic lessons on this head. The present king of the French has within that period supported himself by the labor of his own hands; the rich and noble of Europe, driven from their homes and possessions by the arms of a successful soldier of fortune, have become artizans, agriculturists, and manufacturers, while men like the merchant and mariner of our own city, have, during the same eventful period, risen from obscurity, and stamped their names indelibly on the page of history. I, therefore, earnestly press the claim of the Institute upon the rich and liberal, and trust that it will not be received with cold indifference. But we part from this theme to turn our attention to a more pleasing one—in the displays with which we have been periodically greeted at our exhibitions, we have recognized the fruits of our labors and efforts to diffuse useful knowledge among our mechanics and manufacturers. Year after year we have witnessed the march of improvement, and the collection of useful and ornamental articles by which we are surrounded, compared with the humble collection that we first displayed in the Carpenters' Hall, furnishes us with just cause for present gratulation. We must not, however, be satisfied with what we have attained; we are almost annually reminded, in

tones from abroad that cannot be unheeded, of what is doing there. Many of you have doubtless read the graphic accounts from the French press, of the great exposition of arts and manufactures lately held in the city of Paris, at which the hands of royalty itself distributed the prizes, and proclaimed the honorable distinctions that had been earned by the citizens of the great empire. There the display was measured by miles, here we feel content to estimate it by feet, and although the republican simplicity of our manners and customs may not seem in harmony with such magnificence, yet our proper feelings, as part of a nation that yields to none in the world in natural advantages, would suffer no very severe trial if such a record could pass to our posterity as part of the history of the nineteenth century. If the proper spirit be once aroused among us, the accomplishment of this would not be difficult; in works of internal improvement, and the mechanics connected with them, we are perhaps in advance of Europe; in the possession of popular government, regulated by the will of the people, and in the regulating and controlling that will, we are doubtless more highly favored than they. We fail, however, in a comparison with them in the monuments and associations of ancient times, which engender a patriotic spirit of a peculiar cast, and lead them to undervalue that which is new and rapidly progressive.—Watched as we are by such jealous eyes, and viewed from abroad with more suspicion than favor, let us put off the self-satisfied spirit which is too often the stumbling block in the path of improvement and happiness. While we have youth and energy as a nation, let us lay broad and deep the foundations for social happiness and national independence and honor. Let us cherish those institutions, which, founded upon an equal regard to the rights and necessities of all, are attending to the great work of educating our people; not educating them in narrow and imperfect views of their duty to God, their neighbors, and themselves, but in a noble and catholic spirit, fitting them for any emergency that may arise in the republic.

As we have regard to such principles in what we are doing in our day, so will our career as a nation be distinguished. The false distinctions that ignorance makes between individuals, will disappear, and instead of the sneer of the miscalled practical man at the philosopher, we shall find philosophy and practice so intimately blended in the same man, as to cause the mind to doubt whether the prejudice to which we have referred could have ever really existed. The philosopher whose name distinguishes our institution, was a noble example of the union at which we aim; unaided by such lights as now shine upon the pathway of the student, he may be said to have first formed *the tools*, and then with them wrought himself up to the stature of immortality.

To the youth of our day we recommend the example of Franklin, in fitting himself by study and self-discipline to be a teacher and model for the world. To the rich we point his admirable practice of the lessons he had learned; and to all we say in the language of the great and learned teacher of wisdom,—"Happy is the man that findeth

wisdom, and the man that getteth understanding, for the merchandize of it is better than the merchandize of silver, and the gain thereof than fine gold."

AMERICAN PATENTS.

List of American Patents which issued in May, 1844, with Remarks and Exemplifications. By CHARLES M. KELLER, *Examiner of Patents.*

1. For an improvement in the *Horse Power;* A. D. Childs, Rochester, Monroe county, New York, May 6.

This horse power, like many before it, is on the general principle of the sun and planet movement; motion is communicated to a central vertical shaft provided with a mitre wheel near its lower, and a pinion near its upper end, the former driving the line shaft, and the latter receiving motion from three planet wheels arranged at equal distances around it, and each provided with a pinion on its arbor, the teeth of which take into cogs on the inner periphery of a permanent ring. The planet wheels turn on, and are carried around the central shaft by studs projecting downwards from a cap plate, (so formed as to make an entire covering to the whole machine,) which is guided and kept steady in rotating by means of rollers that embrace a flanch projecting from the outer periphery of the permanent ring, and others which bear against the inner periphery of the ring—the central shaft having its upper bearing in the centre of this cap plate.

Claim.—"What I claim as my invention, is the method of sustaining the upper end of the centre shaft, and guiding the pitch of the planet wheel pinions by means of the cap, as described, which is guided by rollers on the studs of the cap, under the planet wheels, bearing and rolling on the inner periphery of the planet ring, by means of which a stationary centre is dispensed with, and the wheels are protected."

2. For improvements in the apparatus for manufacturing *illuminating Gas, and for mixing it with measured quantities of atmospheric air, &c.;* James Crutchett, a subject of the queen of Great Britain, and now residing in Cincinnati, Ohio, May 6.

Claim.—"I claim the combining of two, or more, drums on the same shaft, so that they shall revolve together in a suitable case, or vessel, containing water, in the same way with the drum of the ordinary gas metre; one or more of which drums are so arranged and combined as to draw in atmospheric air, oxygen, or air and vapor, to be mixed, in measured proportions, with carburetted hydrogen, the proportionate quantity of each being governed by the capacity of the respective drums, upon the principle set forth. I claim the combining with the atmospheric air, previously to its mixture with the car-

buretted hydrogen, a portion of the vapor of naptha, spirits of turpentine, or other suitable inflammable liquid, whether this combination be effected by means of an apparatus constructed precisely as herein described, or in any other way in which the same end is attained; I do not claim the combining of atmospheric air with the vapor of hydro-carbons, when such combination is intended to be applied immediately to the purpose of illumination, without a subsequent combination thereof with carburetted hydrogen: my claim in this particular having reference solely to the production of a triple compound of air, vapor, and gas, with which to supply the burners; by which combination also I effect great economy in the production of artificial light. It is here to be clearly understood, that I do not claim as of my invention, the case furnished with trays to contain naptha, or other volatile liquid, for, although I have introduced some improvements therein, it is not new in its general arrangement. I claim the manner described of regulating the supply of oil, or other fluid, or fused matter, from which gas is to be made; the rising of the gasometer being made to close, and its descent to open, a cock, or valve, by which such supply is governed. I claim combining with the dipping box the vent tube proceeding from the cock, as set forth, for the purpose of drawing off the volatile oil, without allowing of the escape of gas."

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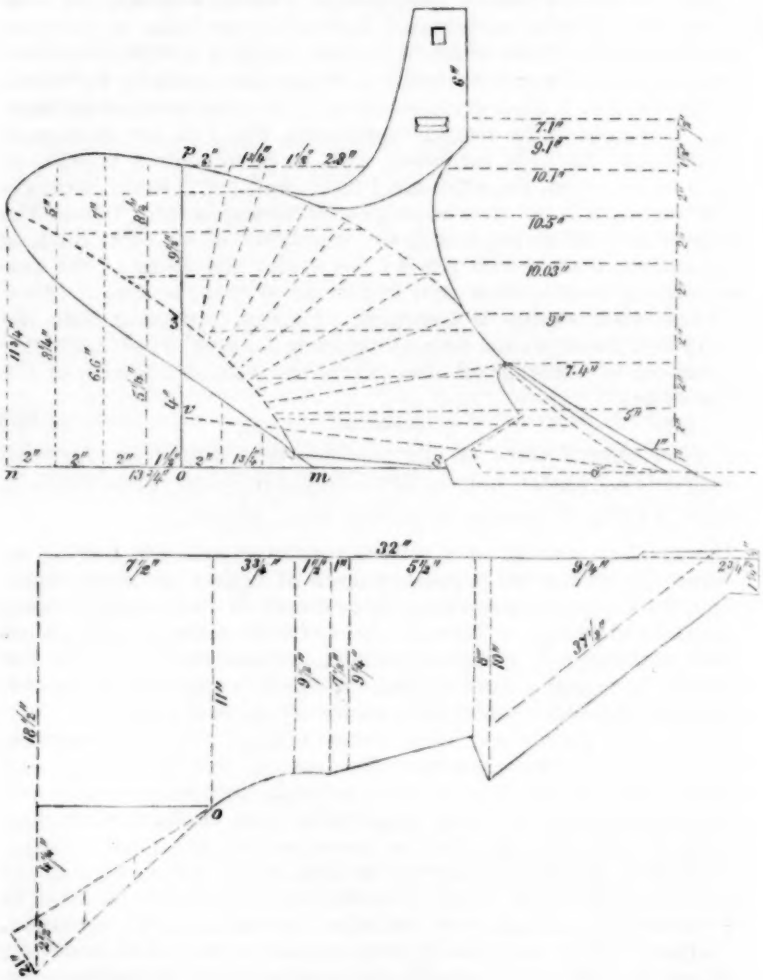
3. For an improvement on the machine for *computing Interest, measuring Lumber*, and for other similar purposes; Jehu Hatfield, Glenn's Falls, Warren county, New York, May 6.

This machine consists of a vertical revolving cylinder, having on its outer surface vertical parallel columns of figures, or signs, representing the interest on the several sums shown in a stationary column on a surrounding case. There is also a circular scale, or dial, placed in front of the case in a vertical position, to indicate the days of the month, with an index hand, or pointer, which is operated by the cylinder--the two being connected together by mitre wheels.

Claim.—"In the old revolving interest tables," says the patentee, "there was a cylinder containing the interest, having the days and months stated at the head of each column, (instead of a dial and pointer,) enclosed in a round paste-board case, or box, having an opening in front with the principal pasted on one side; the cylinder being made to revolve by turning the shaft at the lower end with the fingers; and, therefore, I wish it understood that I make no claim to any part of this arrangement, but what I do claim as my invention, and which I desire to secure by letters patent, is the before described combination of the revolving cylinder, containing the vertical columns of numbers indicating the interest, with the permanent vertical scale showing the principal, and the dial representing the days and months, for which the interest is to be ascertained, and the pointer operated in the manner and for the purpose set forth, or in any other mode substantially the same, by which analogous results are produced."

4. For an improvement in the ***Cast-iron Plough;*** Aaron Smith, Bloomfield, Oakland county, Michigan, May 6.

The accompanying diagram and claim will give the reader a clear idea of the improvement patented, viz.,—"What I claim as new, and desire to secure by letters patent, is the particular manner in which I



form the face of the mould-board, as set forth; that is to say, by taking a radiating point in the particular position, designated in the drawing by the letter *v*, in the perpendicular line *o*, *p*, and at a height above the plane of the sole of the plough, such as is herein designated, and from *v*, as a centre, so forming all the radiating lines between the

point *v*, and the upper end of the perpendicular *p*, as that a straight edge shall touch the face throughout the said range; the lines between the perpendicular, and the end of the board, being straight, and inclined over, as described, and the lines of the face of the mould-board parallel to its base also being straight as set forth."

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5. For an improvement in the apparatus for *Distilling Grain;* Benjamin Roop, Mount Pleasant, Westmoreland county, Pennsylvania, May 6.

The mash tub is to be surrounded by a jacket at such distance from the bottom and sides as to leave a chamber into and through which steam, or water, is to be conducted for the purpose of heating, or cooling, the mash.

Claim.—"I do not claim the mode of heating and cooling by a steam, or water, jacket; but what I do claim, is said water, or steam, jacket, in combination with a mash tub and mash rake, for the purpose of heating and cooling the mash."

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6. For an improvement in the mode of *Setting Logs on Saw-Mill Carriages;* Benjamin Webb, Warren, Herkimer county, New York, May 6.

The slide of the tail block projects beyond the side of the carriage, and is there provided with a roller, which, as the carriage is run back, comes against an inclined guide, by which it is pushed with the log on it; and, for the purpose of keeping up this action, the inclined guide is attached to a slide which is, at each forward movement of the carriage, drawn towards the carriage a distance equal to the thickness of the plank to be sawed, and there held by a pall, on the slide catching in the teeth of a rack on the floor below the slide. The moving of the slide is effected by an arm that extends from and beyond the end of the tail block slide, provided with a latch, which, on the forward movement of the carriage, acts on the back face of a bevel attached to the plate of the inclined guide, and back of it; this bevel is made adjustable for the purpose of regulating the thickness of the log to be sawed, and the catch is jointed, so that, on the return of the carriage, it may pass over the bevel.

Claim.—"What I claim as my invention, is setting the end of the log by causing the end of the slide upon which the log is dogged, as the carriage is gigged back, to come in contact with an inclined guide, which is again moved laterally towards the carriage the required distance for another and similar set, as the carriage advances towards the saw, by means of a latch, or other similar appendage, in contact with an inclined gauge, or adjustable bevel, attached to the slide carrying the aforesaid guide, in which position the said inclined guide and gauge are held by a pall attached to the said slide dropping into a rack fixed on the frame of the mill, or other suitable place, and this method of setting the log I claim, whether it be effected by the combination of parts above set forth, or any other, substantially the same for producing like results."

7. For an improvement in *Wrought-Iron Wheels;* James McCollum, Wilsonville, Shelby county, Alabama, May 6.

Claim.—"What I claim as my invention, is the described mode of uniting the hub and the spokes, by making the latter embrace the former, instead of being inserted as heretofore done, by which arrangement the connexion between the hub and the rim of the wheel is stronger, and the hub is less liable to bend out of the central line."

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8. For a mode of *Catching Moles;* Thomas Shailer, Haddam, Middlesex county, Connecticut, May 10.

A number of pointed wires are attached to a sliding board, with their points downwards, and to the upper part of the slide there is attached a cord, which passes over a roller, to hold up the slide with its teeth, or wires, and having its other end provided with a fly lever, connected by means of a notch with one end of a trigger lever, the other end resting on the surface of the ground, so that the moving of the earth by the mole shall liberate the fly lever, and permit the slide with the pointed wires to fall on to the mole.

Claim.—"What I claim as my invention, is the manner in which I have combined the lever, one end of which is to rest on the ground, with the sliding board, and the pointed wires with each other, and with the other parts of the trap, so that the raising of the ground by the mole shall cause the wires to descend; the respective parts being arranged substantially as described."

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9. For an improvement in the machine for *Planting Rice and other Grain;* Richard I. Gatling, Murfreesborough, Hartford county, North Carolina, May 10.

In this machine there is a horizontal roller with channels, or grooves, in the direction of its circumference, and at distances apart equal to the space between the furrows; above this is placed a hopper, with a leather bottom, resting on the roller, and having a hole for each channel, through which the rice, or other grain, passes into the channels, by which they are carried down into inclined spouts, that discharge them in the furrows, prepared by teeth, forward of the inclined spouts.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combination and arrangement of the perforated hopper, revolving channeled cylinder, and inclined conductors, as described."

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10. For an improvement in the *Double Plough;* Aaron Smith, Bloomfield, Oakland county, Michigan, May 10.

This is termed by the patentee, the "Double Sub-Soil Plough:"—"It has two mould-boards, and their proper appendages, placed one before the other on the same beam; the hind plough being so proportioned and arranged as to raise and lay its furrow slice on that of the forward one." The forward plough is smaller, and does not cut so deep as the hind one.

Claim.—"I do not, in this patent, make any claim to the manner

in which I attach the land-side and mould-board to each other; nor do I herein make any claim to the particular manner in which I form the face of the mould-board; nor do I claim the placing of two mould-boards upon one beam; nor the causing of the rear plough to throw its furrow slice upon that of the fore plough, these having been effected by a plough for trenching; but having ascertained by varied experiments, that not only the special form of the outline of the two boards in their relationship to each other, as well as that of the turn of their surfaces, are points of great importance, I do claim the special

Fig. 8.

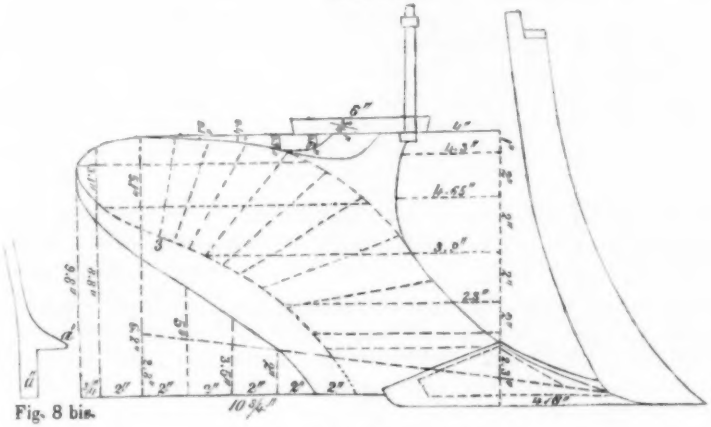
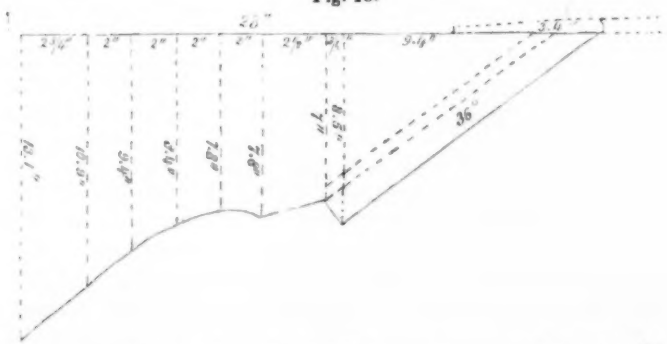


Fig. 8 bis.

Fig. 15.



form given to the two boards in their outlines, as designated by the numbers on the vertical and horizontal lines in figures 8 and 15, and on the lines showing the width in figures 7 and 14, (see accompanying diagrams;) these numbers, however, being taken as relative, as the size of the whole plough may be varied. It will be manifest, that in making this claim I cannot intend that these measurements should be taken with mathematical exactness, but that the outlines and proportions should be substantially the same with those set forth. I claim the particular form given to the heel of the hinder mould-

board, as shown by the triangular space *a'*, *s*, in fig. 8, and the hind view of this part in fig. 8, bis, by which form the slice deposited by the fore plough is left undisturbed, and that cut by the hind plough is raised preparatory to its being deposited upon it."

Fig. 7.

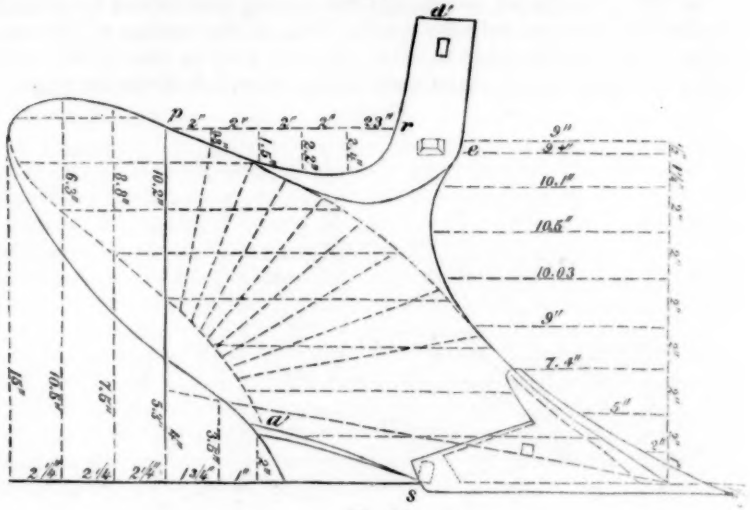
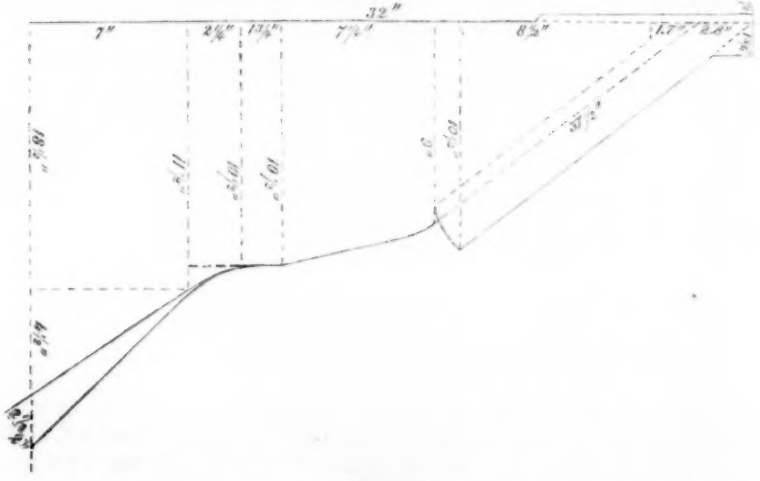


Fig. 14.



11. For an improvement in the *Caps of Hand Lamps;* Robert H. Eddy, Boston, Massachusetts, May 10.

This is for an improvement on an oil feeder and lamp cap, patented by Joseph Benson, on the 28th of February, 1844, and noticed in this Journal at page 245, of volume viii, 3rd series, to which the reader is

referred, to enable him fully to understand the improvement set forth in the following—

Claim.—"I shall claim the combination of a cup, or receptacle, with the chamber, the object of the said cup being to catch any carbon which may drop from the inflammable portion of the wick; also the addition to, or combination with, the cap of the inclined lip surrounding the exterior edge of it, and extending from and above, the object of the said lip being to prevent any oil, or carbon, that may be in the cup, from running over and dropping on the outside of the lamp whenever the lamp is turned over into a horizontal, or inclined, position; also making the chamber entirely within the collar, or neck, in combination with a lip raised upon the upper edge of the collar; the object of such an arrangement being to arrest any oil which may escape through the screw of the lamp cap, or between that formed upon the exterior of the chamber, and the interior of the collar: the whole of the above being constructed and operating substantially as specified."

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12. For an improvement in the method of applying *Water, or Animal, Power as a motive force;* John A. Wiszt, Philadelphia, Pennsylvania, May 10.

The general principle of this device is well known, and has often, in by-gone years, been patented, and abandoned as often as essayed. It consists of an inclined wheel on a horizontal shaft, so connected with it, as to be capable not only of changing its inclination relatively to the shaft, but of causing any part of its circumference to assume the lowest point of the inclination, whilst the shaft remains vertical, so that a weight, whether water, or animal, or any other ponderous body, traveling around on the wheel, will cause every portion of its circumference in succession to descend to the lowest point, without rotating the wheel, and thus causing the shaft, which passes through an enlarged and flat hole in a cylinder, that turns freely in the hollow hub of the wheel, to rotate.

The claim is limited to the manner in which the connexion between the wheel and shaft is formed, and as it refers to, and is wholly dependent on, the drawings, we are under the necessity of omitting it.

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13. For an improvement in *Life Preservers;* Callistus Augustus De Liancourt, Paris, France, assigned to Joseph Francis, of New York City, May 10.

We deem the insertion of the claim sufficient to enable the reader fully to understand the character of this improvement.

Claim.—"What I claim as my invention, is the making of life preservers, buoys, rafts, and other articles for buoyant purposes, by distending the air bag with a helical spring, or with separate hoops, or rings, of iron, or other metal, whalebone, or any kind of wood, covered with any suitable, or proper flexible, material, and in combination with this the mode of making and attaching ends of any proper material, one of which is provided with a valve, by which arrange-

ment the permanent elastic force, or stiffness, of metal, or other material, used for distending the bag, is substituted for the uncertain elastic force of air, substantially in the manner described."

14. For an improvement in the machine for *Cutting Crackers, &c.*: John Johnson, and Otis Freeman, Boston, Massachusetts, May 17.

Claim.—"We shall claim causing the cutter frame with the cutters, after the impression has been given upon the dough, to move away from the inclined bed, or apron, over the bed, and leave the scraps and waste dough upon the apron, or bed, and to drop the crackers, or biscuits, upon a shelf, or other suitable receptacle separate from the apron, or bed, all in the manner as above set forth; the said shelf, cutters and apron being constructed and operating substantially as set forth; also the mechanism by which the cutter frame is operated and turned from a horizontal position to an inclined one, the same consisting of the curved bar, and horizontal bar, in combination with the mechanism which draws the cutter frame towards the inclined apron, or bed; the whole being constructed and arranged as set forth."

15. For an improvement in the *Washer, for cleansing Satinets and Woolen Cloths;* William Soule, Stafford, Tolland county, Connecticut, May 17.

This is for an alleged improvement on the washer, which consists of two rollers; the box in which the rollers work is divided into two compartments, an upper and a lower one, by a partition perforated with holes, for the passage of the cloth, and others provided with valves to retain the suds in the upper, or permit it to descend into the lower chamber.

Claim.—"What I claim as my invention, is the application of the partition and valves for the upper suds chamber, with the cocks for drawing off the suds, when retained in the upper chamber, to the washer described and set forth."

16. For an improvement in the *Cooking Range;* Herbert H. Stimpson, Boston, Massachusetts, May 17.

Claim.—"I do not claim the introduction of the smoke, heat, or other volatile products of combustion, to the sides of an oven of a cooking range through lateral flues proceeding from the boiling chambers, or space under the boilers; but that which I do claim consists in the manner of arranging the flues which proceed from the boiling chamber and fire place, and pass in contact with the oven, so as to equally, or thoroughly, distribute the heat over the exterior of the oven, and permit the operations of baking and boiling, to be carried on without shutting off, or interrupting, the communication between the fire place and flue space beneath the oven, and around its sides; the said arrangement consisting in carrying the lateral flues, or those proceeding from the boiling chambers, directly against the front parts, or halves, of the sides of the oven, and thence horizontally over, and in contact with, the top thereof, and opening the same at the top of

the oven into the discharge flues, as described, in combination with carrying the main discharge flue of the fire place beneath, and in contact with the oven, and around and in contact with the rear parts, or halves, of its sides and top, the same being connected with the discharge flue leading to the chimney, and the whole being substantially as set forth."

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17. For an improvement in the *Smut Machine for cleaning Wheat, &c.;* Henry B. James, Mount Holly, Burlington county, New Jersey, May 17.

This machine is a modification of that class of smut machines which have been extensively used, and which, therefore, have been the prolific source of improvements, or modifications, and hence of patents. It consists of a set of beaters, or fans, on a vertical shaft within a case, through which the grain passes to receive the action of the beaters, or fans, and of an upward current of air produced by the action of the fans. In this instance, the case is conical, and fluted on the inside, and the beaters, or fans, are constructed in a manner fully expressed in the subjoined claim. The top of the case is provided with a spiral flue, or trunk, through which the grain passes into the machine, and where it is acted upon by the current of air before it reaches the beaters, or fans.

Claim.—"What I claim as my invention, is the arrangement of the circular trunk, as described, to conduct the air, and float out foreign matter from the machine, and the fans constructed of two, or more, sets of leaves, or plates, arranged one above another on a common shaft, said plates being placed diagonally upon said shaft, and arranged so that the leaves of one tier shall break joints with those above them, to act upon the grain, in combination with a stationary inverted cone, roughened on the inner surface by slight flues, or otherwise, and to produce a current of air through the machine, as described."

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18. For a *Harrow, or Sward Cutter;* Dennis Rice, Rowe, Franklin county, Massachusetts, May 17.

The teeth of this harrow are arranged in the usual manner, in a triangular frame, but, instead of being straight and pointed, they are bent back in a segment of a circle, with the front edge sharp, to cut the sward.

Claim.—"What I claim is the mode described of constructing the sward cutter harrow; that is to say, by using and combining with the harrow frame a suitable number of movable harrow teeth of the above description, for the purpose specified."

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19. For a *Revolving Rule*, for measuring surfaces, and particularly applicable to lumber; Charles Ross, Piqua, Miamia county, Ohio, May 17.

A wheel, of one foot in circumference, is so arranged in a case, as to have a portion of its periphery project beyond the case, and a por-

tion of its face visible through a hole, the edge of which is graduated to correspond with concentric circles on the face of the wheel, graduated in the manner of the common lumber rule. The shaft of this wheel is geared with the shaft of a cylinder, so that the latter will make one revolution to thirty-six of the former, there being thirty-six divisions to indicate the number of revolutions made by the wheel; and the shaft of this cylinder is geared with another cylinder, which makes twelve revolutions to one, to mark the number of revolutions made by the first cylinder. The scales on the wheel and cylinders are so arranged as to give the superficial as well as the running measure.

Claim.—"What I claim as my invention, is the combination of the common board rule with the self-calculating cylinders, and their combined application to the measurement of plane surfaces in general, but more particularly to the measurement of the superficial contents of boards, plank, and lumber."

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20. For an improvement in *Lamps;* Henry B. Fernald, Boston, Massachusetts, May 17.

In this lamp there is an annular distributing reservoir some distance above, and communicating with the burner by a tube, (designated in the following claim by the letter *a*,) and by another tube (*b*,) with a hand pump, in a main reservoir in the pedestal of the lamp, by which the oil is forced up into the distributing reservoir. There is another tube to discharge the surplus oil from the distributing reservoir, and the tube (*a*) that supplies the burner, into the main reservoir—the tube (*b*,) for these purposes, extending to the upper level of the distributing reservoir, and communicating by a hole with the tube (*a*) at, or near, the level of the burner.

Claim.—"I claim the apparatus added to, and combined with, the burner, and the main reservoir, for the purpose of maintaining the oil in the wick case at a constant level, with respect to the wick; the same consisting of the distributing fountain, and tubes (*a* and *b*) proceeding therefrom, and opening into, or communicating with, each other, (at the level, or about the level, of the top of the burner,) and with the column, or reservoir, as before set forth; the whole being arranged and operating in connection with the burner and fountain beneath the same, substantially as specified."

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21. For an improvement in the *Smut Machine for cleaning Grain;* Abraham Straub, Milton, Northumberland county, Pennsylvania, May 17.

"The nature of this invention consists in forming an involuted conductor for the grain, from the centre to the periphery, under the fan upon the runner, at which point it is subjected to the action of the beaters, and wind from the fan at the same time, and is cleaned of all the loose dirt and smut as fast as it is broken.

Claim.—"What I claim as my invention, is constructing the runner in the manner set forth, having involuted conductors on it, intersected

at the periphery by beaters, and surmounted by a fan; the whole being arranged substantially in the manner and for the purpose specified."

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22. For a machine for *Trimming the ends of Bristles in making Brushes;* Samuel Taylor, East Cambridge, Middlesex county, Massachusetts, May 17.

The brush to be trimmed is placed on two guide rails made adjustable, to regulate the length of the bristles; and below this is a plate with V shaped teeth, made sharp at the sides, and below this, and in contact with it, there is a rotating cutter, which acts in connexion with the teeth, in the manner of shears, to cut the surplus length of the bristles.

Claim.—"I claim the apparatus, or means, of receiving and holding the bristles to be cut, (the same consisting in a series of teeth, &c., extending from a plate, and having their edges, or sides, sharpened as described,) in combination with one, or more, revolving, or movable, cutters placed directly beneath the said teeth, and arranged and caused to pass in contact, or nearly so, with them, so as to act in connexion therewith, similar to scissors, or shears, and cut, or separate, those parts of the bristles extending below the teeth from the remainder, or parts above them, and thereby reduce all the bristles of the brush as set forth; and I also claim the combination, with the above, of the mechanism for holding, or guiding, the block, or brush, or presenting the bristles to the cutters and teeth, in such manner as to cause them to reduce, or cut, the said bristles to a regular, or requisite, length; the said mechanism consisting of the adjustable rails, or guide bars, arranged over the cutters and teeth, and in connexion therewith substantially as described."

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23. For an improvement in *Awnings for the front of shops, &c.;* John Sebo, Wilmington, Delaware, May 25.

This awning is attached, by its upper end, to a roller having its bearings in staples attached to the house, and its other end to a pole, and from this pole a set of sustaining cords extend over the awning around the roller next the house under the awning, and thence around a roller on posts at the edge of the walk; and below this, and revolving with the same velocity, there is another roller, on which wind another set of cords. The first set of cords not only sustain the awning, but, by winding on the roller at the top of the posts, answer the purpose of rolling it up on the roller next the house, whilst the second set of cords unroll it—the two sets rolling and unrolling on the two rollers, which have for this purpose equal velocities.

Claim.—"What I claim as my invention, is sustaining the roller, next the house, by means of a cord passing over pulleys, and winding up with the cloth, conducted in the manner and for the purpose set forth; I also claim, in combination with the awning, the rollers, one for the awning, and the other for the sustaining cords, as described."

24. For an improvement in *Oil Boxes for preventing journals from heating;* Elisha Reid, Columbus, Georgia, May 25.

Claim.—"What I claim as my invention, is the prevention of heating journals and boxes, by surrounding the boxes with a reservoir of water, in such manner as to prevent the access of water to the oil box and journals, as described, thereby preventing heat, and, consequently, the drying away of oil, and wear of the rubbing surfaces, and the necessity of frequent oiling, using for the reservoir any material suitable, and any composition of metal for the bearings."

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25. For an improvement in the process of *Converting Iron into Steel;* Simeon Broadmeadow, New York City, May 25.

The patentee says,—"My improvement consists in the using of a permanent roof of fire stone, or fire brick, in place of the temporary covering heretofore employed. I also use a sliding shutter, which is placed in front of the furnace, so that it may be brought down as required. My improvement in the manufacturing of the steel, after the process of cementation has been completed, consists in the taking of the bars first from the upper part of the convertory, whilst they are at the highest temperature to which they are to be brought, and subjecting them immediately to the action of tilting, or of rolling, without the necessity of reheating. To do this, a part of the upper layer of bricks, which enclose the converting oven, is first removed, so as to enable one to draw out the upper bars, and as the bars are successively operated upon, the bricks are further removed, until the whole contents of the convertory have been tilted, or rolled. As this process goes on, the sliding shutter is brought down, so as to enclose the part from which the bricks have been removed. By this procedure several advantages are attained in the process of manufacturing steel. Under that hitherto followed, the whole charge has been allowed to cool down before removing the steel from the convertory, and this necessarily resulted in great loss of time; the bars after being removed, had to be reheated, in order to their being tilted, or rolled: by this reheating time was consumed, and the steel actually injured, it being a well established fact, that every time steel is highly heated it is deteriorated."

Claim.—"What I claim as new, is the improvement herein described, of taking the steel from the oven in its heated state, and subjecting it to the action of rollers, or of the tilt hammer, without the necessity of reheating the bars; by which improvement said manufacture is greatly facilitated, and the quality of the steel much improved."

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26. For improvements in the *Engine, to be actuated by Inflammable Gas, or Vapor;* Stuart Perry, New Port, Herkimer county, New York, May 25.

"In my inflammable gas, or vapor, engine," says the patentee, "the power which is to be obtained from it for the driving of ma-

chinery, is to be produced by the expansion consequent upon the combustion of vapor of spirits of turpentine, or of other evaporable inflammable liquids, or of gas, or vapor, or gas and vapor combined, obtained from undistilled turpentine, or from rosin, or such other substance as will produce inflammable vapor, carburetted hydrogen, or other inflammable gas, by the aid of atmospheric air, within a cylinder similar to that used in the steam engine. It is well known to engineers, that various attempts have been made to generate power by the combustion of explosive compounds within a cylinder; the expansive force of such compounds, when ignited, being in some cases allowed to act directly upon a piston, whilst, in other cases, the compounds have been exploded for the purpose of obtaining a vacuum, into which the piston might be forced, by pressure induced on the other side of it; but such attempts have not resulted in the production of a machine which could be practically used with advantage."

Claim.—"What I claim is the manner in which I have combined and arranged the air-pump, the reservoir, the retort, the air regulator, and the cocks which govern the admission of atmospheric air into the valve box, and their appendages, as described; by which arrangement I am enabled to supply the inflammable gas, or vapor, in regulated proportions, and to produce a pressure within the cylinder slightly exceeding that of the atmosphere, at the moment of opening one of the ignition orifices, which outward pressure is to be immediately succeeded by a draught inwards, this being effected in the manner and for the purpose described. I claim also the manner set forth, of heating the retort, by employing the heated air which escapes through the eduction tubes, so as to render such air effective in converting the combustible fluid employed into vapor."

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27. For a combination of matter constituting a *Cement, or Pigment, to prevent the oxidation of metals, and as a protection against moisture and fire;* Edward Deutsch, France, May 25.

[See Specification.]

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28. For improvements in *Weaving Looms;* James Nield, Taunton, Bristol county, Massachusetts, May 25.

We are under the necessity of omitting the claims of this patent, as they refer to, and are wholly dependent on, the drawings which are necessarily complex and numerous. If deemed sufficiently important, the specifications and drawings will be given in a future number.

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29. For an improvement in the machine for *Cutting Shingles;* Jonathan P. Bartley, Flanders, Morris county, New Jersey, May 25.

Two or more knives for cutting the shingles are affixed to the periphery of a hollow drum, with a flanch at each end; the shingles, after being separated from the bolt by the knives, pass through slots in

the drum, which constitute the throats of the cutters, and are conducted out of the drum, and clear of the arms by curved guides.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the employment of the drum, in combination with the knives, for cutting shingles, and the curved guides for carrying off the shingles; the whole being constructed and arranged substantially as set forth."

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30. For an improvement in the *Mill Bush;* Robert M. Wade, Summit Point, Clark county, Virginia, May 25.

The mill bush is enlarged to receive rings of leather packing, which surround the spindle, and rest on the bottom of the hollow bush; these are held down by a metallic piston forced down upon the packing by a screw cap; the oil chamber, for containing oil, &c., to supply the packing and spindle, is formed by a groove in the upper face of the piston, and a corresponding one in the under face of the cap screw; the former being provided with holes for the discharge of oil at the junction of the packing and spindle, and the latter with holes for pouring in the supply of oil.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is constructing the mill bush with an annular chamber, for containing the oil, or other lubricating substance, used for oiling the mill spindle, by making corresponding circular grooves in the bottom of the screw cap, and in the top of the piston, which thus answer the two-fold purpose of oil chamber and driver, for keeping the annular rings of leather packing, contained in the cylindrical cup, lubricated, and against the spindle, in the manner and for the purpose set forth."

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31. For an improvement in the machine for *Mortising and Tenoning Timber:* Elbridge Lyman, Northfield, Franklin county, Massachusetts, May 25.

The chisel for mortising is attached to one end of what is called, in the specification, a head piece, attached by adjusting screws to the upper end of the slide usually employed in mortising machines for holding and carrying the chisels, and the two chisels for cutting tenons, to the other end of the said head, so that by simply reversing the head the machine can be employed for either purpose without the necessity of taking off one, and substituting another, set of chisels.

Claim.—"I claim arranging the two sets of chisels (tenoning and mortising) upon one movable and reversable head, instead of disposing them upon separate heads, in the usual manner."

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32. For an improved mode of *Drafting, to cut garments;* Henry Isham, Montpelier, Washington county, Vermont, May 30.

This method consists of three measures, variously formed and applied to different parts of the body, with measuring tapes attached to them; but the form and general character of these could not be made

clear without drawings of them, as applied to the body, which would carry us beyond the limits of this work.

Claim.—"What I claim is the combination of the three described measures for the purpose described; and also the first and third measures described for the use and purpose described."

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33. For an improvement on the *Scraper, for making and repairing roads;* Samuel G. Sutton, Yorkshire, Cattaraugus county, New York, May 30.

This scraper consists of a triangular frame composed of two side pieces hinged together at one end, and connected together at the other, by a clamp brace, that it may be made wider, or narrower, at pleasure. The lower edges of the side pieces are armed with iron. The team can be attached to staples on either side of the end hinge, as occasion may require the earth to be removed to one side, or the other, and when the earth is to be moved forward the team is to be attached to the wide end. There is a piece, called the gate, hinged to the back end of either of the side pieces at pleasure, and provided with a handle to enable the operator to change its position, as may be required."

Claim.—"What I claim is making the two sides of the scraper with a hinged joint at one end, and a clamp brace at the other, that the two sides may be separated, or brought nearer together, for the purpose and in the manner described. I also claim the gate, in combination with the scraper, for the purpose and in the manner described."

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34. For a process for obtaining *Malleable Iron directly from the Ore*, by treating the same in a puddling furnace; Simeon Broadmeadow, New York City, May 30.

Claim.—"What I claim as new, is the effecting of such reduction, (the reduction of the ore into malleable iron,) by mixing, in due proportion, the ores known as oxides, and as carburets of iron, (without the necessary admixture of fluxes, or carbonaceous matter,) and exposing them to a proper temperature, for fusing the same, in a furnace, so constructed that the flame shall not reverberate upon the mass, but shall pass over it in contact, or nearly in contact, therewith."

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35. For an improvement in *Propelling Steam-Ships, and other vessels;* Peter Von Schmidt, Washington, District of Columbia, May 30.

A wheel having naves in manner similar to a rotary fan blower, and a top and bottom plate attached to and moving with them, and extending from the ends of the naves to within such a distance of the shaft as to admit water to enter, is placed and works within a case in a recess in the vessel below the water line, and provided with tangent pipes leading and extending to the stern, bow, and sides of the ves-

sel; these pipes are provided with shutters which can be closed and opened at pleasure. The rotation of this wheel produces a current of water, by centrifugal action, in, through the hollow centre, and out, through the tangent pipes of the case, so that by closing any of the pipes the vessel will be impelled in any desired direction.

Claim.—"What I claim as my invention, is the employment of a wheel enclosed in a case, as described, having tangent pipes leading forward, back, and out at the sides of the vessel, in the manner and for the purpose set forth, the whole being submerged in a recess in the vessel, and acting in any direction at the will of the engineer, without reversing the motion of the wheel, or in any way checking the engine by means of shutters, or gates, arranged as described."

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36. For an improvement in the *Hemp Cradle, for cutting Hemp;* Griffin Reynolds, Jr., Washington, Mason county, Kentucky, May 30.

In this cradle there is a brace which extends from the end of the knife, or blade, along the ends of the fingers, (and attached to them) up to the top, and there bent over to form the upper finger. Instead of the finger board, used in Laramore's cradle, which runs up for some distance from the top of the knife, or blade, there is a round finger some inches above the blade, and connected with and braced to it by round screw studs, to prevent springing and clogging.

Claim.—"The said Griffin Reynolds, jr., claims, as his improvement on the Laramore cradle, the combination of the knife, constructed as described, with the front brace and space between the first finger and the knife."

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37. For an improvement in machinery for *Dyeing, Sizing, or Impregnating, Woolen, Cotton, or other Yarn;* William A. Burke, Manchester, Hillsborough county, New Hampshire, May 30.

Claim.—"I claim the method by which I am enabled to effect the passage of the yarn from one set of squeeze rollers to the other, throughout the series thereof, without its receiving, during the same, more tension than is necessary to operate the stop motion; the same consisting in arranging and actuating each set of squeeze rollers, so that the yarn shall be passed by and between its rollers at a slower rate, or speed, than it does through the set immediately preceding, and applying a stop motion to the yarn, and each set of squeeze rollers, in the manner set forth; so that the slackening of the said yarn, between each two sets of squeeze rollers, shall throw the machinery, by which one set of said rollers is revolved, out of action, until the succeeding set is enabled to take up the surplus yarn; also the method by which the yarn (or coils thereof,) is protected from entanglement and friction, while passing and being wound several times around the various squeeze and dipping, or other, rollers, and steam cylinders of the mechanism, viz., by arranging the said rollers and cylinders in the angular positions, with respect to the general course of the yarn through the machine, or with respect to the frame

work of the machine, as described; the whole mechanism being constructed and operating substantially as described."

It is only necessary to add that there are improvements in the kind of machinery used for this purpose in which the yarn is dipped into a succession of vats, passing from one set of rollers into a vat, from this up to a set of squeezing rollers, thence into another vat, and so on.

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38. For an improvement in the machine for *Drilling Iron, or Boring Wood;* Amos Morgan, Wooster, Wayne county, Ohio, May 30.

The drill mandrel is driven by a cog-wheel on a shaft below, taking into a pinion on it; and the drill is fed forward by a nut on the screw of the mandrel—this nut is on a hand-wheel, and on one side of the hand-wheel there is a cog-wheel for the purpose of running back the drill, by means of a cog-wheel on the driving-shaft below it, and on the other side a face ratchet connected with a lever, which is actuated by an adjustable cam on the driving shaft. There is a piece jointed to the lever in such manner, that when the pall is in place it forces it against the ratchet, and, when thrown back, holds it from the ratchet.

Claim.—"What I claim is the screw and mandrel, constructed and combined in the manner described, in combination with, and driven and fed up to the work by means of a driving-shaft and spur-wheels, and adjustable cams thereon; the said cams driving the screw by means of the lever, pall, and ratchet, the shaft being moved in a lateral direction by the pinion on said mandrel; the whole being constructed, combined, and arranged in the manner and for the purpose described. I also claim the piece (for holding the pall,) in combination with the lever and pall for holding the pall to or from the ratchet wheel, as set forth."

Specification of Letters Patent granted to EDWARD DEUTSCH, *of Havre, France, for a composition of matter constituting a Cement, or Pigment, to prevent the Oxidation of Metals, and to be used as a protection against moisture and fire; on the 25th of May*, 1844.

Be it known, that I, Edward Deutsch, of the Kingdom of France, residing in the city and port of Havre, have invented a new composition of matter, and improvement in the preparation and combination of materials not known, or used, by others before my discovery thereof, and not, as I believe, now in use, or for sale, in these United States—certainly not with my consent, or allowance—yielding a production which will be found of general utility in its various modes of combination; among others, as a cement, or pigment, supplying the means of preventing the oxidation and deterioration of metallic substances, and of precluding the infiltration, or percolation, of fluids, and the absorption of dampness, or moisture, preserving from the

injurious effects thereof, and even in some cases guarding against destruction by fire; which can be used with great advantage and economy, especially in all things that are wanted to be made water tight, in all edifices and constructions in which stone, wood, timber, earth, or metal, is employed; for vessels, steamers, steam and other engines, cordage, various tissues and textures, leather, and in general for materials used in various arts and manufactures. And in order to enable persons skilled in the arts, to make and use my invention, I will proceed to describe the materials employed therein, the mode and process of its composition, and its application.

The bases consist in all substances that are combustible, and not metallic compounds, such as bitumen, asphaltum, pisasphalt, maltha, mineral caoutchouc, and products obtained from the distillation of fossil coal.

Formula I.—Of the substances above described as bases, particularly bitumen, put any given quantity into the boiler of a still, prepared for the purpose; lute the apparatus, and heat it in such manner that the essential oil and water embodied in the bitumen shall, during the process of evaporation, be condensed by the cold water contained in the condenser, or cooler, of the worm; and at that point when the distillation produces only a few drops of liquid, sift the material which remains in the boiler through metallic cloth, or sieves, placed over a vessel of sufficient capacity, and containing water to prevent adhesion to the bottom, or sides; when it has been reduced to a temperature equal to fifty, or sixty, degrees centigrade, (122 to 140 Fahrenheit,) take the material out of the water, and mould it into lumps.

Formula II.—To the material prepared as per formula No. I, add from one to twenty-five per cent. of protoxide of lead, or of any other oxide, and you will obtain a substance more, or less, inflammable, according to the proportion of oxide which may have been used and fused together.

Formula III.—To the material prepared as per formula No. I, add from one to one hundred per cent., or more, of grease, or adipose, matter, and you will obtain a product more, or less, friable in proportion to the greater, or less, quantity of adipose matter used.

Formula IV.—To the material prepared as per formula No. I, add from one to one hundred per cent., of siccative oil, especially of linseed, and as much caoutchouc, or gum elastic, or mucilage, and you will obtain a paint, or pigment, peculiarly adapted to various textures, tissues, cloths, paper, &c., and leaving them perfectly flexible.

Formula V.—To make black varnish of great beauty, you must, after heating the bitumen until it has become liquid, sift it through very fine metallic sieves previously heated, and then add from one to one hundred per cent. of resin, or of resinous gum of any sort, then put the bitumen, thus prepared, over the fire, and leave it so until the essential oil and water contained therein shall be evaporated, then add spirits of wine, or oil of turpentine, or other of the same nature, until the whole be of proper thickness for use.

Sealing wax of great beauty can be obtained by following this

(the VIth) formula, saving the addition of spirits of wine, or essential oil, which must be omitted.

This product mixed with saw, or marble, dust, or sand, or with the filings, or oxides of metals, &c., will answer to make walls, statues, vases, terraces, &c.

In all cases in which it is desired to give this product more, or less, flexibility, there may be added, besides resin and resinous gum, wax, and especially from one to thirty per centum of sulphur.—From the essential oil produced by the distillation of bitumen, there is obtained naphtaline in greater quantity, and of purer quality than by the distillation of tar, or pitch.

What I claim as my invention, and desire to secure by letters patent, is the combination of the materials prepared as per formula No. I, named in the foregoing specification, and other known substances of the same nature, with the various ingredients therein referred to, or other known substances of the same character, according to the different formulas set forth.

List of American Patents which issued in the month of October, 1841, *with Remarks and Exemplifications. By* CHARLES M. KELLER, *Examiner of Patents.*

1. For improvements in the machine for *combing and preparing Wool, Flax, &c.;* Francis A. Calvert, Lowell, Massachusetts, October 9.

The patentee says,—"My first improvement consists in the manner in which I arrange the teeth around the revolving table, or disk, so as to cause the teeth to rise in a line with the periphery, or so that the circle generated by the revolution of their points, shall not be smaller than that of the periphery of the disk. My second improvement is in the manner of furnishing the combing cylinder, which I use instead of the wire teeth combing wheel employed by Wright & Hawkesley, and of the brush, or wire teeth, used by William W. Calvert. My third improvement is in the using of an endless belt above the combing cylinder, for the purpose of cleaning the fibres from the teeth of said combing cylinder, and of laying them in such manner as that they shall be ready to be received upon the teeth of the revolving disk. My fourth improvement consists in the causing of a current of air, or of steam, to be blown upon the fibres of wool, or other material, as they are delivered from the combining cylinder to the toothed disk, in order to prevent the hanging down of any of said fibres below the teeth, by which they would be prevented from being properly combed, and also in directing a similar blast in a horizontal direction against the combing cylinder, to prevent the fibres from lapping around said roller, and to lay them close on to the combing cylinder. My fifth improvement is the substituting for the apparatus called the universal sweeper in William W. Calvert's machine, a blast of air, or of steam, which is directed on to the fibres as

they are about to pass from the revolving disk to the drawing rollers, thus causing them to be perfectly taken up by said rollers."

Claim.—"First, I claim, in combination with the combing cylinder of the machine herein described, the so arranging of the vertical teeth around the periphery of the revolving disk, as that the circle generated by the revolution of their points, shall not be less than that of the periphery of the disk, thereby avoiding the forming of a shoulder which will interfere with the near approach, and advantageous action of the combining cylinder, as set forth. Secondly, I claim forming the teeth of the combining cylinder of plates of metal, instead of from wires, inserted into a metallic strip, as heretofore practiced; said metallic plates being attached to the cylinder by screws, or kerfs, in the manner described, or in any similar manner which will avoid the formation of a shoulder, which has a tendency to become clogged, and thus interfere with the action of the machine. Thirdly, I claim the combining with the combing cylinder in a machine for combing wool, flax, &c., an endless belt made to revolve above said cylinder, in the manner and for the purpose set forth. Fourthly, I claim the blowing of a current of air, or of steam, in a vertical direction, through a flat tube, situated immediately below the point of action, between the revolving disk and the combing cylinder, for the purpose and in the manner set forth. Fifthly, I claim the employment of a similar tube and current directed horizontally over the top of the upper feeding roller, and against the combing cylinder, for the purpose made known. And sixthly, I claim the directing of a current of air, or of steam, against the combed fibres as they are passing from the revolving disk to the drawing rollers, for the purpose of elevating such portion of said fibres as might not otherwise be duly taken in between said rollers; the whole being constructed and operating substantially as described."

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2. For an improvement in the *Pump for raising liquids;* Henry Rogers, Auburn, Cayuga county, New York, October 9.

The object of this improvement is to enable one pump to serve for the raising of several kinds of liquid from a cellar, or other apartment, containing barrels, or other reservoirs, having in them the several kinds of liquid which are to be raised and delivered in a store, bar-room, or other place. The body of the pump consists of a metallic cylinder of such capacity as may be required, and this is to be furnished with a piston, the rod of which extends downwards through the lower end of the cylinder, and is worked by a lever under a counter, or in any other convenient situation. From a head, or cap, on the upper end of the cylinder descends a number of tubes which are to pass through the floor, and are to be connected respectively to the barrels, or other vessels, from which the liquors are to be raised. In the centre of the cap from which the respective tubes proceed, there is inserted a spigot, or key, which is to be turned like that of a common cock, and which, by the position it is made to occupy, will determine the kind of liquor to be drawn, and will direct its discharge into the vessel which is to receive it.

Claim.—"What I claim as new, is the manner in which I employ a revolving key, or spigot, made tubular at its lower end, and having a slot, or opening, through it, so that said slot may be made to coincide with either of several openings in the socket, within which it revolves; said openings, with the exception of one of them, being connected by a tube with an appropriate reservoir, and, the one above excepted, being connected with a discharge spout; the whole apparatus being constructed, arranged, and operating substantially as herein described."

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3. For an improvement in the *Screw Press, and in the apparatus for separating Elaine from Stearine;* Richard Jones, Circleville, Pickaway county, Ohio, October 9.

This "improvement in the screw press consists in attaching to the shaft of the screw a scroll, or fuzee wheel, to the larger end of which scroll, or fuzee wheel, one end of a rope, or chain, is to be attached, and after being wound around said scroll wheel, or fuzee, the other end of said rope, or chain, may be attached to a windlass, or to a second scroll wheel made to operate as a windlass, or the rope may be passed over a pulley, and be drawn upon by a weight affixed to its end."

Claim.—"What I claim as new, is the combining of the scroll, or fuzee, wheel with the screw, by placing the former on the shaft of the latter, and employing it in the manner, and for the purpose set forth. I do not claim the use of a scroll, or fuzee, wheel, as applied to a press, for the purpose of obtaining a progressive increase of power, this having been before done; but I do claim the direct application thereof to the shaft of a screw, as set forth. I likewise claim the manner in which I use alternate plates of solid and of perforated metal, between the packages of lard, tallow, &c., in the trough, so as to provide spaces between each pair of plates, for the ready escape of the elaine as described."

The principal object of the above press is for the separation of stearine from elaine; and the last section of the claim is to a mode of arranging the tallow, or lard, in the box of the press.

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4. For an improvement in the *Floating Dry Dock;* Daniel Dodge, and Phineas Burgess, New York City, October 9.

This is for an improvement in that kind of docks known under the appellation of the sectional floating dry dock, and consists in connecting the machinery employed in moving the end floats in all the sections together, by means of universal and extension joints, that the distance between the sections may be varied without breaking the connexion of the shafts.

Claim.—"It will be remembered that we have described parts which have long since been used in floating dry docks, and that, therefore, we do not claim them as our invention, but what we do claim, and desire to secure by letters patent, is the method herein described, of moving the end floats in all the sections, with the same

degree of velocity, so as to insure an equal strain upon all the parts of the vessel, to be raised by connecting the main shafts on all the sections, on each side, by universal and extension joints, substantially as herein described."

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5. For an improvement in *Mills;* Josiah Platt, Weston, Fairfield county, Connecticut, October 9.

Claim.—"Now I am aware that the upper stone, or runner, of a mill for grinding grain has been operated by a spindle working in boxes above it, and that it has been weighted by attaching weights to the top thereof, and hence I do not claim for these things; but I wish to confine my claim to the peculiar manner in which I have effected these things; that is to say, I claim as my invention and improvement, and desire letters patent for suspending the spindle of the upper stone, or runner, by a sliding frame, in the manner and for the purpose specified. I also claim the suspending the upper stone, or runner, to the lower end of the spindle, by having the bail work in a slit, or cleft, in the spindle, and the two jointed together, and fastened by a pin passing through them, as described; and finally, I claim regulating the weight and friction of the upper stone, or runner, by placing semi-circular weights in a cavity, made therefor, in the upper part of the whirl, or wheel, as described."

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6. For an improvement in the mode of *Causing the Wheels of Locomotive Engines to adhere to the Rails;* Elisha Tolles, New York City, October 9.

Claim.—"What I claim as new, is the manner of constructing and combining the apparatus for the distribution of sand upon the lines of rails on railroads, by the conjoint action of reservoirs of steam and of sand, the sand to be placed in a reservoir from which the steam is allowed to issue through pipes, or tubes, surrounding those through which the sand is made to issue, by an arrangement of parts substantially the same with that set forth. I also claim the combining with the apparatus, for distributing the sand, the scrapers, or ploughs, for cleaning the rails from snow, or other foreign matter, said scrapers being attached to elastic arms of metal, and otherwise formed, arranged, combined, and governed in the manner described.

"It will be manifest that instead of passing a current of steam through the outer tube, or pipe, to cause the sand to be discharged from the inner tube, a strong current of air, either heated, or not, may be forced through the outer tube, and that a like mechanical effect would be thereby produced. Such a blast may be derived from a blowing apparatus of any suitable kind, such as are well known, and often used with locomotives; and I therefore claim the substituting, in the apparatus herein described, a blast of air for the current of steam."

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7. For an improvement in *Lightning Conductors;* William A. Orcutt, Boston, Massachusetts, October 9.

Claim.—"What I claim as my invention, is the method of connect-

ing lightning rods, or conductors, by means of a nut, or hollow cylinder, with the receiving, or discharging, point cast thereon; but I expressly disclaim the invention of connecting rods of metal by a nut, or hollow cylinder."

The ends of the rods to be connected, are screwed into this nut, from which the receiving, or discharging, point projects at right angles to the longitudinal axis of the rods.

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8. For an improvement in *Blinds for Horse Bridles;* John G. Tibbets, New York City, October 9.

"The nature of this invention is to construct the bridle with leather arch blinds, nearly encircling the eyes, projecting forward and spreading outward in such a manner as not to chafe, or heat, the eyes, and exclude the air, and torture the animal, and eventually cause him to become partially, or entirely, blind, but to allow the eyes to be entirely free, cool, and open to an unobstructed circulation of the air around them, and to a direct view forward and laterally, of objects in their natural light and form, and at the same time prevent him from seeing what is going on behind, or over, him, and thus prevent him from taking fright from these causes, and suffering the evils complained of; said blinds being susceptible of an addition, or wing, at right angles thereto, for the purpose of preventing the animal seeing to the right, or left; said improvement being applicable to the bridles of carriage, as well as saddle horses."

Claim.—"What I claim as my invention, is the before described mode of constructing bridles arching over the eyes, and flaring, in combination with the flanches, or wings, in the manner and for the purpose set forth."

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9. For a *Support for Copy Books in Teaching Writing;* William Davison, Baltimore, Maryland, October 9.

"This copy support is a rectangular piece of tin wired around the edges, to which is attached the copy book wings and clasps by hinges. The book is riveted to a piece of tin hinged to the before described wire, at one end of said support, or back, the corners of the said piece of tin being cut off to permit the book to open freely when it stands supported at the angle required."

Claim.—"What I claim as my invention, is constructing the copy book with hinges, or wings, to support it when opened, as described, and, in combination with said wings, the clasps for retaining the leaves in place when the book is opened and supported."

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10. For an improvement in the *Art of Writing*, by a construction of fountain pens, adapted to writing on a guide formed of ground glass, &c.; William Davison, Baltimore, Maryland, October 9.

"The nature of this invention consists in writing upon the surface of ground glass, with a pen of peculiar construction, prepared with fine chalk, so as to render smooth the surface, prevent the spreading

of the ink, and give perfect legibility to the writing, arranged and secured in a peculiarly constructed hinged metallic frame, which folds upon a metallic back, or plate, in the manner of the covers of a book, between which frame and back are placed a series of systematic exercises, or copies, under said prepared glass, the pen with which the ink is laid upon the glass being provided with a reservoir attached to the concave part, which takes a supply of ink at each dip. There is a piece of sponge compressed and put in a cup provided with a handle, for the purpose of washing off the writing.

Claim.—"What I claim as my invention, is the combined employment of a guide, as aforesaid, with a fountain pen of the construction described. I do not claim, as my invention, the attaching of a reservoir to metallic pens, for affording a supply of ink, as reservoirs have been applied to the backs of metallic pens; but what I claim as my invention, is combining the reservoir with the concave side of the pen by attaching a separate sheath to the back of the reservoir, or fountain, into which the pen is inserted substantially as set forth, by means of which arrangement the escape of the ink is prevented on the downward stroke of the pen, as by the pressure upon it, the surface of the pen is removed from the fountain, or reservoir, while in the old arrangement the pressure had the effect of opening the nib, and by bringing it nearer the reservoir increasing the flow of ink. I also claim the employment of chalk on the surface of the ground glass, as described, for the purpose of producing a whiteness on the surface, rendering the writing upon the surface more apparent, and preventing the ink from spreading, and rendering the surface more like paper. I likewise claim the method of employing sponge in a condensed form, by combining it, in the manner described, with a holder constructed as set forth. I also claim the combination of the case, roller, and wiper."

This last improvement consists of a roller within a tin case, which partly surrounds the roller, and then has the two edges turned in contrary directions. The cloth constituting the drier is passed over the roller, and put in the case by springing it open.

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11. For an improvement in the manner of *Casting Butt and other Hinges;* Thomas Shepherd, Philadelphia, Penn., October 9.

The hinge pin, or shaft, is provided with flanches, to form the divisions of the knuckles of the hinge, and the spaces which are to receive the turning half of the hinge, are turned in a lathe, and the others left rough, that the cast metal may adhere. The pins thus prepared are put in the mould, and the spaces intended for the reception of the knuckles of the second half are filled up with sand, and after the first half of the hinge has been cast, it is put in the mould to receive the second half.

Claim.—"What I claim as new, is the casting of butt, or other, hinges, by preparing a shaft of cast metal, in the manner set forth, and laying the same in the flask with the spaces filled with sand, which are to form, or receive, the jointed knuckles of the hinge, and

casting the first half thereon; and, as a component part of the operation, the subsequently placing this half in the flask, prepared as set forth, for the casting of the second half; the mode of procedure in all respects being substantially the same with that above made known. I do not claim the mere manufacturing of hinges by casting the first half, and placing this in the flask, to have the second half cast upon it, nor do I claim the casting of a hinge upon a joint pin, with washers between their joints; but I do claim the so doing, in combination with a shaft, or joint pin, formed and prepared in the manner made known."

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12. For a machine for *Cutting, or Making, Splints of Wood for making Brooms;* Lyman Gleason, Le Roy, Genesee county, New York, October 9.

Blocks of elastic wood, such as is generally employed for making brooms, are cut, by any known machinery, into pieces of the length of the required splints, and as thick as their intended width. These are presented to the operation of knives attached to a cylinder extending from end to end, and at about an inch from the surface thereof; and between the knives and the cylinder there is a spring clearer, which forces the splint out as soon as it is separated from the block. The thickness of the splint will depend upon the feeding of the block to the knives.

Claim.—"What I claim as new, is the employment of the spring clearer, in combination with the knives, and with the curb, for the purpose, and arranged in the manner substantially as described."

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13. For *Raising Water by an Endless Chain of Buckets,* applicable to other purposes; John Dutton, Aston, Delaware county, Pennsylvania, October 9.

As the chain of buckets for raising water is well known, it is only necessary to say that this patent is granted for a peculiar manner of forming the buckets, so as to discharge the water to better advantage into a shoot which carries it off. The mouth of the bucket is narrowed, and the sides extend up, forming flanches on the back, or that side opposite the one on the chain, to form a conduit for directing the water of the next bucket into the shoot, as it begins to turn over the upper drum, and thus save much of the water lost in the old methods of making the buckets.

Claim.—"The invention claimed consists in the mode of constructing the buckets; that is to say, curving the sides inward at the mouth, to form a beak, in combination with the spouts formed on the back of the buckets and the shoot, as before described."

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14. For an improvement in the *Smut Machine for cleaning Grain;* Lewis Greeve, Tiffin, Seneca county, Ohio, October 9.

Claim.—"What I claim as new, is the mode in which I have combined the stationary and the revolving disks furnished with teeth

upon their surfaces, with the revolving arms carrying square, vertical rods of iron, the whole being arranged, combined, and operating as set forth."

The disks are placed above the beaters, and the under and revolving one on the shaft of, and revolving with, the beaters. The grain passes in between the two disks, to be acted upon by the teeth through an eye in the permanent disk, and from these disks it is discharged, and acted upon by the beaters.

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15. For an improvement in *Propelling Vessels;* Daniel Fitzgerald, New York City, October 9.

On each side of, and of sufficient diameter to cover, the bow, there is a large disk working on a shaft, for diminishing (as we are informed,) the resistance of the water to the motion of the vessel.—That "there is more in heaven and earth than is dreamed of in our philosophy," we have the authority of the great poet for saying; and this invention satisfies us that we may add, "and in the brain of some inventors." The vessel is to be propelled by a vertical wheel working within a case under the water line, the paddles passing out below this casing at the bottom of the boat, or vessel, and air is to be admitted through tubes extending from the centre of the wheel to above the water line.

Claim.—"What I claim as my invention, is the application of revolving circular disks to the bow of the vessel, for diminishing the resistance in passing through the water, by separating the particles of the fluid, and turning them aside to prevent the bow impinging on them in sailing with great velocity. I likewise claim the introducing of air to the submerged wheel, in the manner and for the purpose set forth."

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16. For an improvement in the mode of *Building Vessels, Boats, &c.;* Joseph Francis, New York City, October 11.

This is for an improvement on the mode of building boats, &c., on temporary frames, or moulds, by bending boards in courses crossing each other, and the improvement consists in securing the boards to each other by spikes, or tree nails, passing through the width of one board, and into the edge of another.

Claim.—"What I claim as my improvement on the mode of building boats, vessels, &c., on temporary frames, or moulds, is the method of fastening the planking together edgewise, as described."

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17. For a *Submarine Gun Boat;* Daniel Fitzgerald, New York City, October 11.

The patentee says,—"The nature of this invention consists in constructing a gun boat, so that it may be wholly, or in part, submerged at pleasure, having the use of two, or more, large guns; in propelling said gun boat by means of conical, or other shaped propellers, with spiral paddles revolving on and extending over the whole, or part, of

the bow, or stern—in the arrangement of a gunwale on the boat having a cut-water—in elevating bow and stern guns by attaching one on each end of a balance lever; and in elevating and depressing a central gun by placing it upon a platform supported on a piston fitting a cylinder into which steam, or compressed air, is admitted for raising it." To this summary should be added two other improvements described and claimed in the patent, viz, the employment of a spiral propeller at the bottom of the boat, with the shaft vertical, for the purpose of forcing the boat under water, or to the surface; and also a mode of affixing explosive shells to the bottom of an enemy's ship, by means of a pointed bar attached to the shell, one end of which is pointed to enter the enemy's ship, the other passing through an aperture in the side of the boat, with a cord attached to the lock of the shell for the purpose of discharging it.

Claim.—"I do not claim as my invention, the mere employment of a screw, or screws, for propelling boats, as this has long since been done, but not in the manner described by me; and, therefore, what I claim as my invention, and desire to secure by letters patent, is the method described, of propelling boats by means of propellers with spiral, or oblique, paddles revolving around and extending over the bow, or stern, or both, in manner substantially as described. Second, I also claim, in combination with the method of propelling described, the employment of a gunwale on the boat, having a cut-water extending over the propeller, substantially in the manner and for the purpose set forth. Third, I claim the method of elevating the bow and stern guns by attaching one on each end of a balance lever, as described. Fourth, I claim the method of elevating and depressing the central guns, by placing them on a platform, or piston, fitted in a cylinder into which steam, or compressed air, is admitted, as described. Fifth, I claim the method of making the propellers with spiral wings extending in contrary directions, one placed at each end of the vessel, for propelling the vessel, and keeping her steady, and in trim. Sixth, I claim the mode of raising and lowering the boat, by means of the spiral conical propeller, placed in a vertical position at the keel, as described. And seventh, I claim the mode of affixing an explosive shell in the side of an enemy's vessel, by means of a pointed rod in combination with the mode of discharging it, by means of a cord connecting the lock, or match, with the gun boat."

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18. For a mode of *Doubling the Motion of a Crank Shaft*, actuated by a reciprocating motion of any kind; Charles Johnson, Amity, Bond county, Illinois, October 11.

Instead of attaching the connecting rod directly to the crank, as is the usual practice, by which one revolution is given by one entire stroke back and forth, it is attached to one arm of a progressive lever, or toggle joint, the other arm being jointed to a slide from which a connecting rod extends to the crank, so that each stroke back and forth of the piston, &c., vibrates the toggle on each side of a vertical line, and thus gives the slide double the number of strokes.

Claim.—"What I claim is the combining of the progressive, or toggle joint, levers, with a reciprocating shaft with a slide, and with the crank of a fly-wheel, for the purpose and in the manner set forth."

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19. For improvements in machinery for *making Lead Pipes;* Geo. N. Tatham, and Benjamin Tatham, Jr., Philadelphia, Pennsylvania, October 11.

This is for improvements on a machine patented by Benjamin Tatham, jr., and Henry B. Tatham, as the assignees of Charles and John Hanson, of Great Britain, on the 29th of March, 1841, and noticed in this Journal at page 346 of the third volume, third series, to which the reader is referred for an explanation of the general principles of the process and machinery.

Claim.—"We do not claim, as of our invention, any part of the cylinder, or of the dies, nor of the arrangement thereof in the cylinder, nor the manner of adapting these to the hydraulic press, nor the mode of operation generally; but what we do claim as constituting our invention, and desire to secure by letters patent, are first, the long core, or core holder, formed, and held stationary with relation to the dies, as described. Secondly, we claim the constructing of the piston hollow, in the manner described, and the combination of the same with the long core, or core holder, upon which the piston slides. Thirdly, we claim, as a modification of our invention, the arrangement and combination of the several parts above mentioned, as exhibited in what has been termed the 'reverse arrangement.'"

The two first claims need no farther explanation, and as the other would require drawings, we deem it not to be of sufficient importance to add them.

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20. For an improvement in *Ferules for Canes;* Jonathan Ball, Buffalo, New York, October 11.

Claim.—"What I claim as my invention, is the employment of a spiral spring in the ferule of a cane, crutch, or wooden leg, against which the end piece bears, in pressing down the cane, &c., in the manner described."

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21. For an improvement in *Valves, to be applied as throttle, or regulating, Valves in Steam Engines;* William Garlin, Providence, Rhode Island, October 11.

The face of the valve and its seat are semi-cylindrical, and the valve has a stem which passes through a mortise in a vibrating rod, so that the valve adjusts itself at all times.

Claim.—"What I claim as my invention, is the manner of connecting the valve with the rod, so as to adjust itself to the seat on which it moves, by the stem passing up, or down, through the slot in the rod, as the case may be, the whole combined as set forth."

To be Continued.